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Improved Steam Fire Engine.

The illustration represents one of the latest improved engines, made by the Clapp & Jones Manufacturing Co., Hudson, N. Y. It is a piston engine, with the machinery so arranged that the connection between the steam and water cylinders is direct through piston rods, without the intervention of gears, or crank and connecting rod. This keeps the friction practically a constant quantity without reference to whether the engine is working hard or easy. The construction is such that the center line of pressure comes in the center of the framework, thus obtaining the maximum strength with the minimum weight.

The boiler used with these engines was illustrated in the AMERICAN MACHINIST of May 7.

The pump is of novel construction, and such that the dead space is small, providing for high lift. It is made entirely of composition (copper and tin.)

It is so constructed as to require no leather or other forms of packing, which make friction for the plunger. It is self-packed and at the same time frictionless in its working, enabling the engine to maintain a high pressure and a high rate of speed for very long runs, with no danger of packing cutting or blowing out; this is a desirable feature.

The pump heads are simply cages, fitted with inlet and outlet valves of the simplest form of construction, doing away with the necessity of spiral springs to bring the valves back to their places, their own elasticity being sufficient to firmly and quickly seat them without loss of action in the work. The form of openings in the head, together with the form and lift of the valves, insures the greatest ease in the flow of water into and out of the pumps, and precludes the possibility of sticks, chips, or any other of the numerous obstructions which can pass the strainer from in any way interfering with its work. The ease with which the valves are removed (which can be done in less than five minutes), should this from any cause be desired, is an advantage that is appreciated. It is also furnished with a circulating or "churn-valve," which controls a communication between the suction and discharge chambers, so that the engine may be kept in motion to feed the boiler, when it from any cause becomes necessary to shut off the stream, or for relief when small nozzles are used, the water simply passing around through this valve from one chamber of the pump to the other.

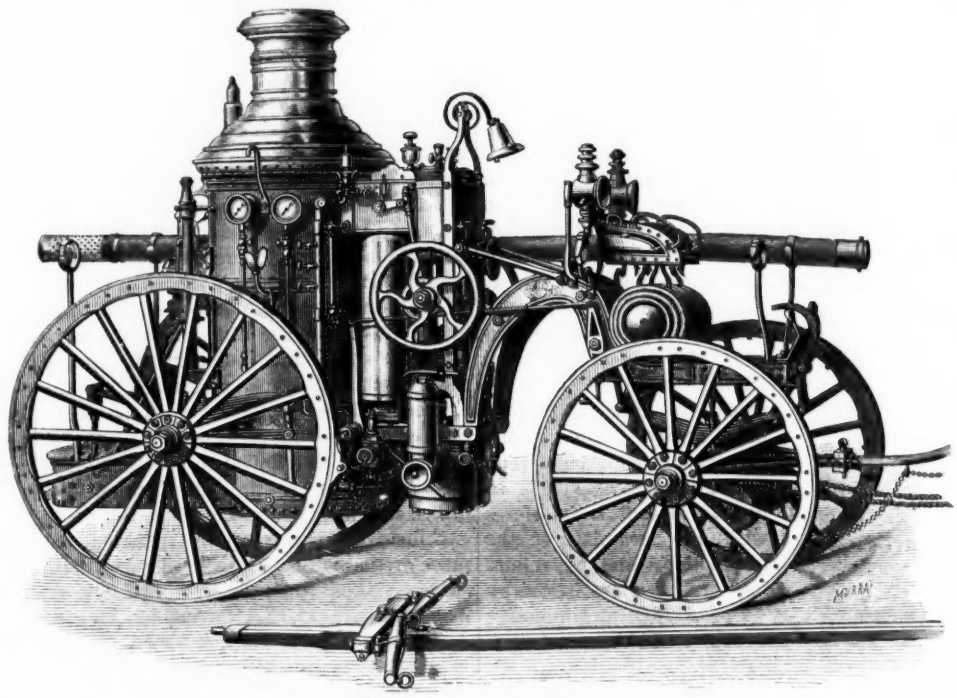
All of the packed joints are so made that the packing is not damaged by taking apart, and will last for years if simply left alone. It is held in place by a dovetailed form of groove, to which it is carefully fitted.

These pumps are made to gauges, and with all like parts interchangeable. That is, the valve chamber in one part will fit in any other part of the same pump or in any other pump of the same size and style in use on these engines, and it is the same with all other of its parts.

There are only two pieces in this pump that have any surface that can be worn by use, and these can be taken out and replaced without disturbing the pump, and at a very small cost, when, no matter how long the pump may have been in use, it will be as good for work as when new.

These engines are mounted on large wheels and strong yet easy springs, and there is so little motion while working that they do not require jacking off the springs or blocking the wheels.

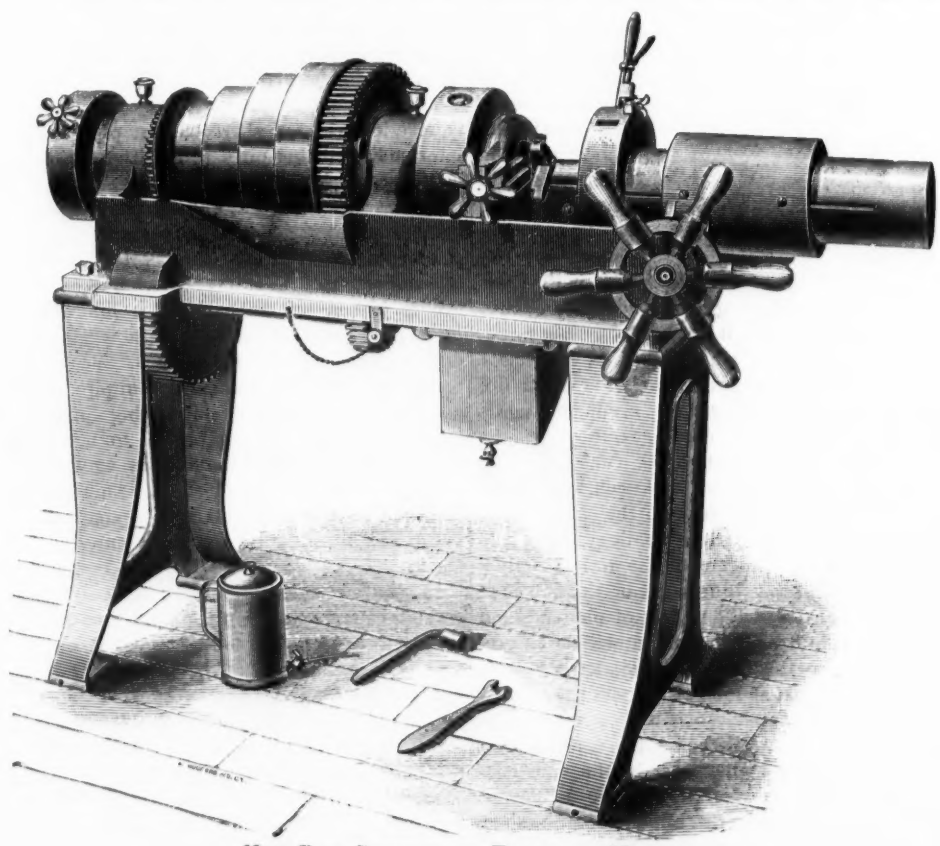
They are manufactured in five sizes, of capacities ranging from 300 to 1,000 gallons per minute.



IMPROVED STEAM FIRE ENGINE.

In a late issue of an English journal we find the following paragraph: "The dispute in the Bolton engineering trade has assumed a new phase. Hitherto the men have refused to work overtime unless their demand for a general advance of wages was conceded. The Masters' Association caused a notice to be put in all the works stating that, after the 14th of May, all workmen will be required to work overtime when necessary. Those refusing will be instantly discharged."

This notice seems to indicate to us that the employers in Bolton must believe the workingman has not the right to determine as to what he shall do with his leisure hours after a hard day's work has been completed. It seems to us that the workingman is expected and must obey every call of his employer, leave the family circle, throw away all opportunities for instruction or amusement; in fact he must not do as he pleases. We believe, on the whole, that American workingmen may congratulate themselves that there is an ocean between them and their English cousins.



NEW PIPE CUTTING AND THREADING MACHINE.

New Pipe Cutting and Threading Machine.

In the design of the 2-inch pipe machine shown herewith, some departure from usual practice appears to have been made.

A proper speed is obtainable for each size of pipe within its range ($\frac{1}{4}$" to 2" inclusive). Four changes are obtained without the back-gear, and four with. These gears are placed directly below the cone, which makes a compact head.

The hole through the spindles admits of a 2" coupling passing completely through. The gripping chuck is of new design, especially made for pipe machines; it is simple and self-centering. A centering chuck is fitted to the back end of the head, doing away with loose bushings.

The cut-off attachment slides on a bar, after the style of a Fox lathe chasing arm, and when not in use is swung back out of the way, giving a clear space between the chuck and die head; thus a pipe may be cut off and threaded without stopping the machine.

The die head is of the opening type and is adjustable to any desired size of variations in fittings. The dies once set can be opened or closed in the dark with perfect certainty of exact results, and they can be taken out and ground on an ordinary grindstone. The dies used are made on a system adopted by the builders some time ago, and have the advantage of being interchangeable, *i.e.*, if by chance a die which belongs to the No. 1 slot of the die head is lost or broken, the firm is able to send an exact duplicate to take its place, thus saving the expense of a full set.

The body or bed of the machine is fitted with a large cast-iron pan, into which the oil runs and which also catches the chips. This pan can be drawn out completely, the oil drawn off, and the chips thrown out. A countershaft arranged for cross belts (for left hand threads) is furnished, and the machine is supplied with dies for threading all sizes of pipe from $\frac{1}{4}$" to 2" inclusive, both right and left hand.

A head can be furnished for taking solid dies. Forbes & Curtis, Bridgeport, Conn., are the manufacturers.

The Billings Expansion Bit.

The object of the invention herewith illustrated is to provide a center-bit free from the objections usually urged against tools of this kind. In the engravings, Fig. 1 is the side view, and Fig. 2 a longitudinal section of the essential parts.

It will be observed that one side of the shank is cut away in a broad and shallow channel, as shown more in detail in Fig. 2. This channel, which is of a uniform cross-section, is bounded at its upper edge by a flaring bevel, and at its lower edge by an under cut shoulder.

The cutter is a strip of steel, having a cutting point or "nicker" and a sharpened front edge, which serves as a router. It is provided with a rear shoulder adapted to engage the shoulder above referred to. The upper edge of the cutter is beveled as represented in Fig. 2, and serrated as shown in Fig. 1. A clamping plate is serrated on its lower edge, and beveled to correspond with the upper edge of the cutter. There is also a throwing-off plate, as shown in the engraving, and a graduated scale and index mark, to indicate the radial extension of nicker, and thus show the size of hole for which the tool is adjusted.

The operation may be described as follows: When the clamping screw is loosened, the spring pushes the plate partly out from the channel in which it is contained; the serrated edges of plate and cutter are thereby disengaged. The latter is then free to be moved to the desired adjustment, as indicated by the graduated scale. Then by turning the clamping screw the parts are firmly fixed.

The manufacturers of this tool are the Billings & Spencer Company, Hartford, Conn.

Extended Smoke Box and Single Exhaust Nozzle.

By J. D. Campbell.

In the past few years the extended smoke box has been applied to the locomotives on many railroads of this country. The character of the men at the head of the mechanical departments of these roads, and the fact that after trial they have not abandoned the extension, but are putting it on locomotives intended for service that taxes the steaming qualities of the boilers to their utmost, and report that it does not interfere with the steaming of the locomotives, should be good evidence that the extension is not detrimental to a locomotive; yet we continue to hear objections to its use—objections that are similar to those of a few years ago in relation to the use of the exhaust pipe with the single nozzle and open stack, and were made by those who believed that in some way which they could not explain the cone in the top of the diamond stack arrested the draft. Looked at in the proper light the extension of the smoke box for the purpose of retaining the cinders is but the application in a simpler form of the principle of the balloon stack that was in common use on wood-burning locomotives, and where the outer shell formed the reservoir into which the cinders were deflected by the cone over the inside pipe. The balloon stack, with the advent of coal as fuel for locomotives, evolved into the diamond stack, and that again into the straight stack or open stack, with the long exhaust pipe and netting in the smoke box. With the use of coal as fuel the outer shell of the balloon stack was abandoned, the interior construction retained, and a diamond shaped casing put around the cone. On a few roads the straight stack with a grating on its top was used; but the grating was as injurious to the stack as the cone, by contracting its area at the top. To make that sufficient the diameter of the stack was increased gradually from the bottom to the top, and the proper proportions between it and the nozzle were destroyed, and to that was added the extra work the exhaust had to do in drawing the gases and itself through the grating. In some instances the short double nozzle and intermediate lifting pipe was used in connection with the straight stack; when this was done the faculty it had for picking up and throwing cinders compelled the use of a still closer grating, and greater disproportioned stack. Many roads after trial abandoned the straight stack; again took it up, only to again abandon it. The principle of induction and the laws of resistance to the flow of gases when compelled to make bends and turns at an angle was known, and also the fact was known that the double exhaust nozzle was not the correct application of the principle, and under the same, that the cone and diamond stack was injurious, and that the single nozzle was the proper means of induction and the straight open stack offered the least resistance. There was no opposition to the principle of the single nozzle, but it was said that it could not be applied to the locomotive, as it allowed the exhaust steam from one cylinder to flow into the other. So strong was this belief that but little attention was given to the reasoning that the proper construction of the exhaust passages and pipe would give such direction to the exhaust steam that it could not flow over unless it returned against its own pressure. Gradually it became evident that it was a simple matter to give this direction to the exhaust. The use of the single and central exhaust nozzle is now quite common, and we but seldom hear the objections once made to its use. But in its place we hear objections made against the use of the extended smoke box. The principal objection made to its use is that it interferes with the steaming of the locomotive; and by retaining the cinders shows a waste of fuel, and indicates a faulty design of boiler.

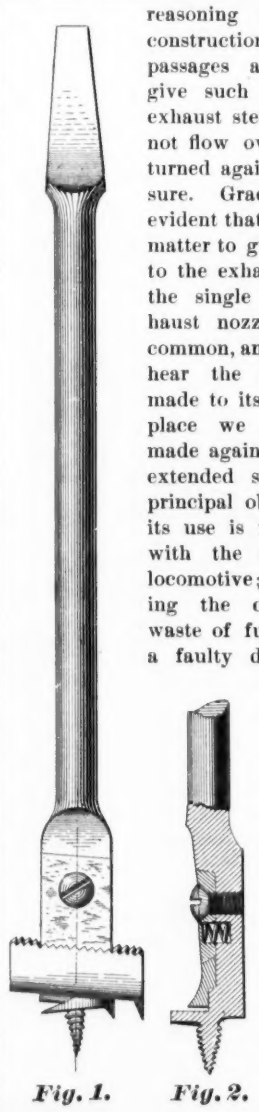


Fig. 1. *Fig. 2.*

Expansion Bit.

Considering the last objection we are willing to confess that the cinders are a waste of fuel, and we are also aware, if no limitations had been placed upon the size of a locomotive boiler, that making it so small, and consequently in order to obtain the required power, are compelled to use such an intense draft which will draw the cinders through the tubes, is a fault. But there is a limit to the size of a locomotive boiler; and since this limit is inferior to the amount of work the boiler has to do, an intense draft must be used, and while the necessity for it continues, there will be cinders drawn through the tubes into the smoke box; and when that occurs the cause which will throw through the smoke stack an amount of cinders coming within the reach of the influence of the draft, is only a question of the difference of the power of the exhaust and the weight of cinders; and their liability to do damage will be in proportion to the amount of cinders thrown, and will exist as long as cinders are thrown out of the stack.

In the past few years there have been many improvements made in the construction and design of locomotive boilers to secure economy, safety and increase of efficiency, until now it is generally conceded that, so far as dimensions are concerned, a limit has been reached that cannot with safety be much exceeded with the present road bed and structures. But the improvements made have been met by increased demands made on the locomotive by increasing the train load and service, so that the intensity of the draft required to-day is as great as that of years ago when smaller boilers were used. We can find no other design of boiler that would safely answer for locomotive service, or would lead us to hope that it would furnish the power required at a lower rate of combustion so as to absolutely prevent the emission of cinders. But should such a happy discovery be made, the fact would yet remain that it would take time to adapt it to all the locomotives of this country, and until this could be done it would be necessary to use some appliance that will prevent cinders from doing damage. It is safe to say that the best appliance for this purpose is one which will keep the cinders in the smoke box of the locomotive and off people's property, and it is also safe to say that retaining the cinders in the smoke-box does not indicate a waste of fuel any more than throwing them out of the smoke stack and out of sight.

The other objection to the extended smoke box is, that it interferes with the steaming of the locomotive. This objection is not sustained by the roads using it, and a consideration of the principle of induction does not show that it should do so, but rather why it should improve it. If the space included within the smoke box, tubes and fire box of a boiler was sealed and the duty of the exhaust was to exhaust the air within that space, increasing this space would increase the work the exhaust had to do, but the space is not sealed, but open at the fire box. The duty of the draft appliances is to induce sufficient air through the grate to support combustion and the efficiency of the appliances must be measured by the amount of gases it can expel at each exhaust, the equivalent of which is the air that enters the fire box through the grates and takes the place of all the gases expelled; or, more properly speaking, the place of that which has moved forward to the smoke box, to take the place of that expelled from it. If, then, the efficiency of the draft appliance is not decreased, or the work it has to do increased by the use of the extended smoke box, there will remain but one source of loss through its use, and that is by lowering the temperature of the gases by expansion, and against this is the benefit to be derived by their being a longer time in contact with the heating surface. Apart from the favorable reports made by those using the extended smoke box, a consideration of the foregoing principle would lead us to suppose that it would favor the draft on a locomotive.

The ordinary smoke box, especially in connection with the short exhaust pipe and intermediate lifting pipe, will, with each exhaust, draw from the tubes a quantity of the gases expelled by it, and the angles and bends they must make in the passage to the stack, compels the use of a sharp exhaust to overcome the resistances; and by it the fire is jerked on the bars. The long exhaust pipe and open stack has less work to do, and better means of doing it. Yet the positions of the exhaust and steam pipe are generally such that the deflecting plates must be placed too close to tubes for a free flow of the gases from them, or at such an angle that they are deflected to the front, from which they must return in a confused mass and at an acute angle to enter the stack.

In the extended smoke box there is enough capacity in its upper portion to hold what gases can be ejected by each exhaust, and enough room for the remainder to easily and with a steady flow take the place of that ejected. The steady flow prevents jerking the fire, and as the proper amount that must flow through the tubes and from the fire box to admit sufficient air for combustion is fixed, the velocity of the gases must be less if continuous than if intermittent, and the less their velocity the less cinders will be drawn from the fire. This feature of the extended smoke box is what causes those who use it say that it operates on the draft like an air chamber on a pump, and its uesfulness is not to be determined by one of its defects, or good quality, but by the sum of each as compared with the same of the other appliances adopted for the same purpose.

When Will the Supply of Natural Gas Fail?

Prof. Leslie says as to the probability of a continuance of the supply of natural gas:

"I take this opportunity to express my opinion in the strongest terms, that the amazing exhibition of oil and gas which has characterized the last twenty years, and will probably characterize the next ten or twenty years, is nevertheless, not only geologically but historically, a temporary and vanishing phenomenon—one which young men will live to see come to its natural end. And this opinion I do not entertain in any loose or unreasonable form; it is the result of both an active and a thoughtful acquaintance with the subject. * * * For I am no geologist if it be true that the manufacture of oil in the laboratory of nature is still going on the hundredth or the thousandth part of the rate of its exhaustion. * * * I hold the same opinion respecting gas, and for the same reasons: with the difference merely that the end will certainly come sooner and be all the more hastened by the multiplication of the gas wells, and of the fire-boxes and furnaces to which it is led."

Over 6,000 men engaged by the shipyards in Belfast have gone out on a strike, and refuse to resume work until the employers agree to pay their wages weekly instead of fortnightly. All work in these yards is suspended.

The first iron steamship contract to which the late Mr. John Roach put his name was that for the building of the City of San Antonio and the last the Nueces; both steamships were built for C. H. Mallory & Co. The Nueces was completed and left the Delaware River Iron Building Company's yard, Chester, Pa., on the 21st of May, to enter upon active duty in the Mallory line. The latter steamship is the fourteenth vessel built by John Roach for the Mallory firm.

Practical Drawing.

By J. G. A. Meyer.

TWENTY-SIXTH PAPER.

Problem 37.

260. TO FIND THE PROJECTIONS OF A TRUNCATED PRISM, ITS DIMENSIONS BEING GIVEN; TWO OF ITS FACES ARE TO BE PARALLEL TO THE VERTICAL PLANE OF PROJECTION, AND THE LOWER BASE PARALLEL TO THE HORIZONTAL PLANE OF PROJECTION.

A truncated prism is one whose upper surface represented by the line *a b*, Fig. 188, is not parallel to the lower base *g h*.

In the problem before us it is required to represent a truncated prism; its lower base is to be 4 inches square, one face or side 5½ inches high, the opposite face or side 2 inches high, and the upper surface represented by the line *a b* is to be perpendicular to the vertical plane of projection.

To represent the form of this truncated prism completely, so that the mechanic can work to this drawing, at least two views, that is, the vertical and the horizontal projections, are necessary; in other words, we must give an elevation and a plan of this solid (see Art. 209). In making these projections it is immaterial which one is made first. Let us commence with the plan Fig. 189. In the first place, with the aid of the T square (held as explained in Art. 79, and illustrated in Fig. 47) draw the two horizontal lines $a_2 b_2$ and $d_2 c_2$ 4 inches apart, and somewhat longer than necessary; then with the aid of the set square draw the vertical lines $a_2 d_2$ and $b_2 c_2$ (use the set square as explained in Art. 81 and illustrated in Fig. 50); these lines must be also 4 inches apart and drawn long enough to intersect the horizon-

tal lines at the points a_2 b_2 c_2 and d_2. The square a_2 b_2 c_2 d_2 is the horizontal projection, or the complete plan of the truncated prism. To find the vertical projection or the elevation of the same, we first draw the horizontal line g h, Fig. 188, at a convenient distance above the plan. With the aid of the set square prolong the lines a_2 d_2 and b_2 c_2 upwards a little beyond the points a and b, and cutting the line g h in the points g and h; the line g h will be the vertical projection of the lower base of the truncated prism. On the vertical line drawn through g lay off 2 inches from the point g, and thus obtaining the length of the face or side g a; in a similar manner make h b equal to 5½ inches; join the points a and b by a straight line, then will g h a b be the vertical projection of the truncated prism.

261. Although simple as these two figures (Figs. 188 and 189) may appear and really are, some of the students may have difficulty in interpreting or reading them correctly; let us, therefore, examine these two projections and compare the same with the rules and principles previously established. In Art. 94 we have stated that all lines drawn parallel to the bottom of the drawing board are always considered to be horizontal lines, and all lines drawn parallel to the left hand edge of the board are vertical lines; also, lines not drawn parallel to these edges will represent oblique lines. Consequently, in our figures, the lines g h, d_2 c_2 and a_2 b_2 are horizontal lines, as they have been drawn parallel to the bottom edge of the drawing board. Again in Art. 220 we have stated that a ground line is a horizontal line, hence, had this line been represented on the drawing it would have been located between and parallel to the lines g h and d_2 c_2, also parallel to the line a_2 b_2. But since the lines g h, d_2 c_2 and a_2 b_2 are parallel to the ground line, it follows—according to Articles 233 and 234— that the line g h and the base which it represents are parallel to the horizontal plane of projection, and the lines d_2 c_2 and a_2 b_2, also, the faces or sides which these lines represent are parallel to the vertical plane of projection; but (Art. 248) the surface of the paper is assumed to represent the planes of projections, hence the truncated prism here represented is shown with two of its faces and its lower base parallel to the paper, and two of its faces perpendicular to the paper. Lastly, since the upper surface of the truncated prism is represented by only one line a b (Fig. 188) it follows—according to Article 247— that this surface is perpendicular to the vertical plane of projection and not parallel to the horizontal plane of projection.

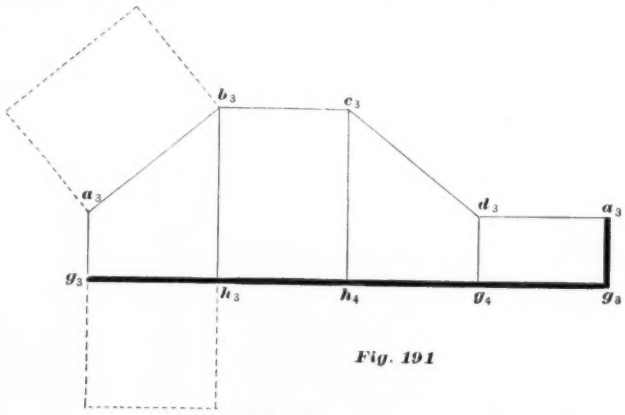


Fig. 191

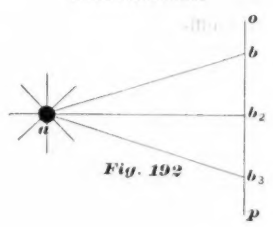


Fig. 192

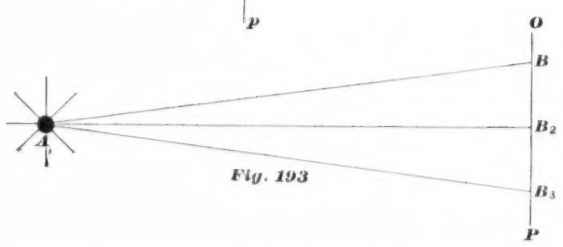


Fig. 193

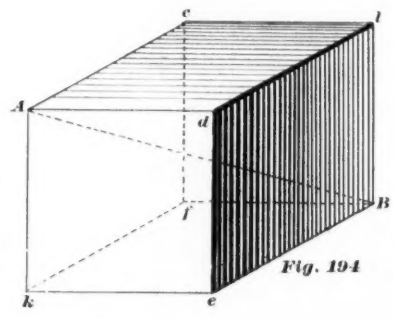


Fig. 194

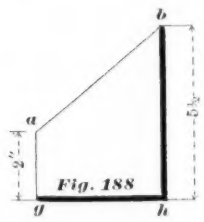


Fig. 188

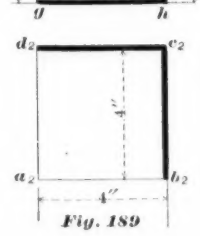


Fig. 189

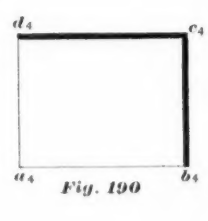


Fig. 190

DEVELOPMENT OF SURFACES.

262. By the development of surfaces is meant the unfolding of the surface or surfaces by which the solid is bounded, and representing the surface or surfaces as lying flat on a plane or the face of the paper, so that the form of the whole surface or all the surfaces can at once be seen. The knowledge of the development of surfaces is of great practical value to the mechanic, and therefore should be carefully studied.

Problem 37 *a*.

263. IT IS REQUIRED TO DEVELOP THE SURFACE COMPOSED OF THE FACES OF THE PRISM SHOWN IN FIGS. 188 AND 189.

By this proposition we are simply asked to find the form of one surface which, when bent around the solid, will fit and cover its faces or the four sides. Of course, in this case, all idea of thickness of the surface must be thrown out of mind.

Fig. 191. Since this surface is composed of the sides of the truncated prism we have only to assume that these sides or faces are placed side by side, close together as shown in the figure; the surface which these will form will be the surface required. Hence, draw a straight line g_3 g_3; on this line lay off the points h_3 h_4 g_4 and g_3; the distances between these points must be equal to 4 inches each; making the total length of the line g_3 g_3 equal to 16 inches; through these points draw lines perpendicular to g_3 g_3. Now let us assume that the development or unfolding is to commence at the edge represented by the point a_2 in Fig. 189, and the line g a in Fig. 188. Now, because this edge is 2 inches long we must make the lengths of both lines marked g_3 a_3 in Fig. 191 measured from the line g_3 g_3, equal to 2 inches, thus obtaining the points a_3 and a_3. The edges represented by the points b_2 and c_2 in Fig. 189 are also represented by the line h b in Fig. 188; and this latter figure indicates that these edges are 5½ inches long; therefore we must make the lines h_3 b_3 and h_4 c_3 in Fig. 191, each 5½ inches long, because these two lines represent the same edges. The line g_4 d_3 represents the edge shown at d_2 in Fig. 189, and since this edge is two inches long we must also make the length of the line g_4 d_3 equal to two inches. Having laid off all these lengths from the straight line g_3 g_3 we have obtained the points b_3, c_3, d_3. Now join the points a_3 and b_3, b_3 and c_3, c_3 and d_3, d_3 and a_3 by straight lines; then the surface bounded by these lines, and also the lines a_3 g_3, g_3 g_3, and a_3 g_3 will be the surface required, or in other words, it will be the development of the faces of the truncated prism.

264. The correct length and breadth of the lower base is shown in Fig. 189, and consequently a separate view of the base is not necessary.

Fig. 189 also shows the correct breadth of the upper surface represented by the line a b in Fig. 188, and since this line a b shows the correct length of this surface (see Art. 247) we have all the necessary dimensions of this surface, and a separate view is not absolutely necessary; but should it be desirable to show a separate view of this surface in which its correct length and breadth is given, then the quickest way to pursue will be the following: Prolong the lines d_2 c_2 and a_2 b_2 in Fig. 189 towards the left, (towards the right would answer the purpose equally well) the distance between these lines will then be four inches, which is the correct breadth of the upper surface; at a convenient distance from the line b_2 c_2, draw a straight line a_4 d_4 perpendicular to the horizontal lines, and cutting the latter in the points a_4 and d_4; from the point a_4 lay off a point b_4, the distance between the points a_4 and b_4 must be equal to the length of the line a b shown in Fig. 188. Through the point b_4, draw a straight line perpendicular to the line a_4 b_4 intersecting the other horizontal line in the point c_4; then will the rectangle a_4 b^4 c_4 d_4 in Fig. 190 represent the correct form of the upper surface.

265. Should it be required to develop in one figure all the surfaces which bound the truncated prism, then add to Fig. 191—as shown in dotted lines—the rectangle shown in Fig. 190 and the square shown in Fig. 189.

If a piece of paper is cut to the outline of Fig. 191, including the dotted parts, and then bent to the lines as h_3 b_3, a_3 b_3, h_3 b_3, etc., a complete truncated prism such as shown will be formed, the paper being the bounding planes or surfaces.

It is advisable for the student to develop on a separate piece of paper the bounding surface of this solid, then cut the paper to the outlines and accurately bend it to the lines on this paper; if accurately made it will form the bounding surfaces of the solid.

266. In these and all the illustrations which are to follow in these articles, similar letters in the different projections or views of one solid always indicate the same point, lines or surfaces.

Directions.—Commencing with the upper left hand space, previously laid off on the paper, mark the spaces in rotation, Prob. 37, Prob. 38, etc.

In the upper part of the space marked Prob. 37 draw the two projections of the truncated prism, according to the dimensions given in figures 188 and 189. Also show a separate view of the upper surface a b as represented in Fig. 190.

In the lower part of the same space show the development of the faces as indicated by the full lines in Fig. 191, and leaving out the dotted lines.

Use a three inch scale. The dimensions given in our illustrations do not agree with the size of the solid as drawn, consequently the student must not expect to see a truncated prism of the same proportions on his paper, as shown in our figures.

267. *Draftsman's Method.*—In drawing these different views the draftsman will proceed in the same manner as explained in this article. Hereafter when the draftsman's method is omitted it must be understood that the draftsman's method of drawing the figures is the same as that explained in the article.

SHADE LINES.

268. It will be noticed that in the illustrations before us some of the lines are drawn fine, and the other lines are drawn considerably wider or heavier. The heavy lines are called the shade lines or shadow lines. These shade lines are very frequently introduced in working drawings by many draftsmen, and indeed, the writer believes that in all cases of practical drawing, whenever time will permit, shade lines should be used. Drawings with shade lines will always have a better appearance than drawings in which these are not used; and what is of still greater importance, the value of a drawing with shade lines is increased, since this drawing can be read more readily and with greater ease, because the shade lines will bring out the surfaces more prominently than an outline drawing without the shade lines. But simply making at random any one line heavier than another, without following some principles or rules to guide us, will not help to make a drawing plainer; indeed it might make matters worse, and a confused drawing, difficult to read, will be the result. Therefore our first duty is to lay down some rules or principles which will help us to determine and pick out in the outline of an object those lines which must be drawn heavier than the remainder.

269. In the first place, light is supposed to emanate from a luminous body, and falling upon the object to be projected or drawn. That part of the object which is towards the source of light is called the illuminated part of the body; and that portion of the body on which the light does not fall is called the shade of the body. Now, the lines which separate the illuminated part of the body from the shade part are the shade lines, and must be drawn heavier than the lines in the illuminated part. Or we may say that all lines which will cast a shadow are called shade lines.

270. Again, light will flow from a luminous body in every direction, and the rays of light as A B, A B_2 A B_3, in Fig. 193, emanating from this luminous body A, will form a system of diverging lines. The divergency is great when the luminous body is near the object to be drawn; the divergency will be diminished when the distance between the luminous body and the object is increased, and the rays of light will become parallel when the distance between the luminous body and the object to be drawn is infinite. Thus, for instance: Fig. 192, let the point a represent a luminous body and the line o p the object which receives the rays of light ab, ab_2, ab_3. Again, let O P in Fig. 193 represent the same object as o p shown in Fig. 192, and A the luminous body, the distance between A and O P being greater than the distance between a and o p in Fig. 192; A B, A B_2 A B_3 are the rays of light, the distances between o p and O P are equal. Here it will be seen that the angles formed by the rays of light A B, A B_2 and A B_3, in Fig. 193, are less than the angles formed by the rays of light a b, a b_2 and a b_3 in Fig. 192. In a similar manner it can be shown that by increasing the distance between the luminous body A and the object O P we decrease the angles formed by the rays of light; and when this distance becomes infinite the rays of light will be parallel. In practical drawing the source of light is supposed to be away an infinite distance from the object to be projected. Consequently when the rays of light are represented they are always shown to be parallel.

271. In practical drawing the source of light is supposed to be located on the left hand side of an object, so that the rays of light will fall upon it in the direction of a diagonal of a cube as shown in Fig. 194; the diagonal being drawn from the point A in which the front edges A c and A d cut each other, to the point B, in which the rear edges B e and B f intersect.

272. When this ray of light—represented by the diagonal A B of the cube—is projected on the planes of projections, the angle formed by the vertical projection of this ray and a horizontal line will be an angle of 45 degrees, and an angle containing the same number degrees will also be formed by the horizontal projection of this ray of light and a horizontal line.

273. The angle formed by the ray of light (not the projections of the ray of light) and either plane of projection is equal to the angle formed by the diagonal of the cube and the lower base of the cube; this angle will contain 35 degrees and 16 minutes nearly.

Therefore, the angle formed by a ray of light, and any horizontal plane will be an angle of 35 degrees and 16 minutes nearly; and an angle of the same magnitude will be formed by the ray of light and any vertical plane.

This subject will be further considered in our next paper.

On a New Method of Making Tubes From Solid Bars.

By Geo. H. Babcock, New York City.

A PAPER PRESENTED AT THE WASHINGTON MEETING OF MECHANICAL ENGINEERS.

We have all heard of the Irishman's method of making a cannon by "taking a hole and pouring melted iron around it," but it has been reserved for a German actually to do a similar or apparently an even more difficult thing—to take a hole and force a bar of wrought-iron or steel around it! We are familiar with the process of drilling and punching for perforating metals, but here comes a man who, ignoring all such makeshifts, by "external applications only"—as a skillful physician treats an internal congestion—rolls a hole into the middle of a solid rod, thus forming it into a tube! What makes the hole? Apparently, like the boy's whistle, it "does itself."

Seriously, this is no joke. The specimens which I have the privilege of exhibiting to the society tell their own story, and scarcely need the evidence of the eye-witness who saw them made, and who loaned them for this purpose. As yet the process has not been worked in this country, but it is in practical operation in Germany. It is the invention of two brothers named Mannesmann, of Remscheid, and the *modus operandi* is as difficult to understand and explain as was Giffard's injector or Bohnenberger's gyroscope.

The apparatus necessary to effect the result consists of two rollers slightly conical, the axes of which are in different planes or form two lines in a twisted surface—their nearest approach being at or near the bases of the cones. The surface of the cones may be threaded in such a way that they tend to draw a body rolling between them towards their larger ends. The bar to be operated upon should be approximately round, and its end is to be inserted while hot between the cones, its axis being intermediate at all points to the axes of the rollers. The action of the cones is to draw out and twist the bar, during which operation a hollow forms in its axis, and when the bar emerges it is a tube with a somewhat rough but approximately cylindrical and concentric bore, the surface of which shows a decided twist.

Among the exhibits is a bar which was drawn down at each end before going through the mill, so that no action took place at these ends. This bar, after cooling, was broken, and shows conclusively by the color and character of the bore that no tool, and not even the air, touched it during the operation, the interior having the same appearance as the fracture.

The tubes thus formed are applicable directly for some purposes; but by a proper formation of the rolls behind the bases of the cones, or additional pairs of rolls, with suitable mandrel or mandrels, this tube may, at the same heat, be expanded and finished into a regular weldless boiler tube or gas pipe, as some of the specimens shown, or this may be done at a separate operation.

That the metal is not harmed by this rather rough handling may be inferred from several specimens shown of tubes which have undergone operations of expanding, flanging, flattening, etc., which would try the temper and quality of any respectable tube. Specimens are also shown of brass and copper tubes made by the same process.

Lost His Presence of Mind.

We regret to note that a prominent manufacturer of printing presses, who has long been a special friend of the American Machinist, has recently lost his presence of mind to a degree that is really alarming. He has lately issued an illustrated circular describing one of his presses as "suitable for papers of limited circulation, and sold at a very low price." The clause about the price is all right, but we are astonished that a manufacturer of our friend's experience should imagine there are, in this country at least, any papers of "limited circulation." There will be none such in trade circles at any rate, so long as names for the distribution of free copies can be found in directories and society catalogues.

"What had we better do," said the superintendent of the road to the president, "for the brakeman who saved No. 3 from being wrecked? Both of his legs are broken."

"We'll give him a trip pass somewhere."

"But the Inter-State Commerce law?"

"True; I forgot that," said the president, with vexation. "Perhaps the law will be repealed, and then we can give him a pass. He's a hero."—*The Sun.*

A Cause of Boiler Explosion.

A very frequent cause of boiler explosion, says the *Manufacturers' Journal*, is the fact that water can be heated far beyond the boiling point, and yet not boil. Water under ordinary circumstances will boil at 212 degrees Fahr., and will continue to boil as long as any air remains in the boiler; but the moment the water is purged of its air by long ebullition, it becomes at rest, and the steam gauge will not indicate any further rise of steam, as there is no further pressure upon it. Now, as the steam gauge does not indicate too much steam, the engineer will naturally suppose everything all right; he will then test the water in the boiler by pressing on the water cock or any communication with the boiler, when by doing so there is a rush of air into the boiler, the now overheated water suddenly begins to boil, and, as there is no possible escape for the immense quantity of steam so suddenly created, the result is an explosion. All this is done much quicker than it takes to tell it.

One of our well known correspondents sends us the above, and writes, not in dead earnest we are bound to believe:

"After a perusal of this, I venture to express the hope that we shall see no more nonsense in the American Machinist about boilers being too weak for the pressures put upon them. I send it to you thinking perhaps that the many engineers who read your paper may be warned in time, and see that they secure ventilation in their boilers.

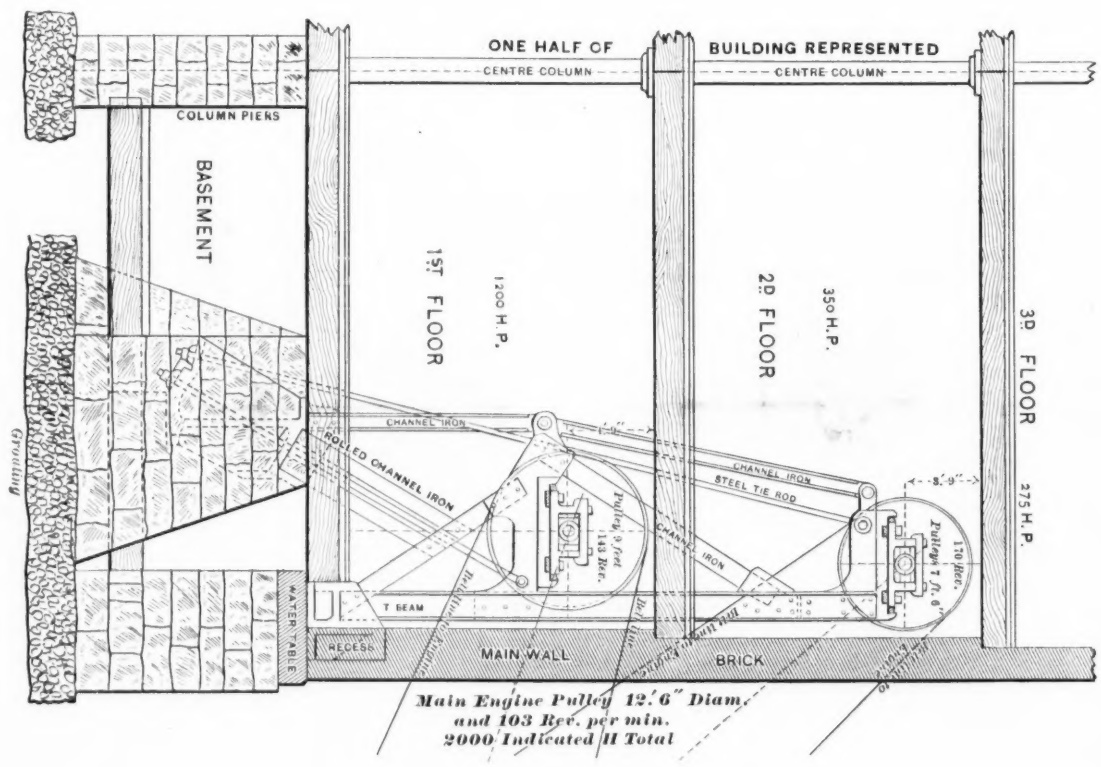
"How would it do to just leave a gauge cock open all the time so that air could enter as fast as needed and thus keep the water in a state of 'ebullition' and so maintain a steady rise in pressure?"

We do not believe our correspondent's plan will work. There must be some peculiar property pertaining to that pressure in the boiler when "the steam gauge does not indicate too much steam" that permits "a rush of air into the boiler." In other words, it is a combination patent, and our correspondent's innovation would break the combination.

The Transmission of and the Modes of Receiving on the Second and Third Movers.

By W. H. Hoffman.

In a previous paper on this subject I stated that I would describe my method of arranging jack shafts in cases where they were placed high above the floors on which the machinery was placed, that these shafts were driving. In speaking of second movers I am designating the jack shafts that first receive the power from the engines or water wheels, and there may be from one to five of these first movers. When I refer to the third movers I am considering the main factory line shafts, that distribute the power to the countershafts driving the machines.



Transmission of Power.

Now a factory equipped with 2,000 horse-power should certainly have the best of foundations, main walls, and floor beams. The first room at the lower floor should not be less than 16 feet to 17 feet from the level of lower floor planking to the underside of the next floor's main floor beams; this distance will give ample length for vertical machine belts, and head room for horizontal main leading belts.

Taking this height, and with a factory building 58 feet wide in the clear at the water table of the foundations, I will now show by a sketch of two floors shown below how a large jack shaft can be carried within 4 feet 9 inches of the main floor beams (considered vertically) without damaging the building in the slightest degree, and will say, in conclusion, that it will pay some mill owners to change their present systems to the one illustrated, the cost being little compared with the advantages gained. All the heavy strains are resisted by the several angular tie rods and struts, while all the weight is supported by four I beams $15 \times 5\frac{1}{2}$ inches, the lower end of these beams resting on an inward extension of the main foundation, while all the diagonal tie rods and struts rest firmly, and are bolted to a separate pier entirely free from any foundation wall, but of very wide base and length. The tie pier is placed central with the length of the jack shafts, and requires a space of 12′ 4″×40′ 6″ in the basement—room that can be readily spared.

Note.—Lower second mover, 143 revolutions per minute; next second mover, 170 revolutions per minute; engine, 103 revolutions per minute.

"The American Style."

An enterprising printer in Glasgow, Scotland, advertises in a Scotch trade paper, that he has provided "expensive machinery" for use in printing machinery catalogues, and that he intends making an earnest effort to "equal, if not excel the iron trade catalogues produced across the ocean and known as The American Style." He may succeed with the catalogues, but how about the machinery advertised? Should not some of that also be built after "The American Style"?

A Heavy Roll.

We observed some time ago that the Carron Company had taken what was for it a new departure, in the shape of opening a large foundry for heavy work. We now learn they have quite recently turned out their first casting, exceeding ten tons in weight, and which is in the form of a roll

for plate-bending machine. The roll measures about 23 feet in length and 3 feet in diameter, and weighs some 16 tons. These rolls are cast on end, and we believe this firm have made arrangements whereby they can cast such up to 30 feet in length and weighing nearly as many tons. This seems to indicate a movement among shipbuilders in favor of building with very long plates, the handling of which demands lengthened rolls. Doubtless it is seeing this tendency towards an increase in the size of ships' plates that the Carron Company has taken measures to anticipate the demand which will be likely to follow a revival of the shipbuilding industry.—*The Engineer.*

Mr. W. B. Strong, president of the Topeka and Santa Fe Railway Company, made the following sensible remark in a recent address. A good many corporations seem never to have taken his view of the case:

No corporation should ever forget that its powers are given to it for the public convenience and benefit, and it is the part of wisdom no less than of justice to faithfully observe this principle. * * * *

The true policy for our company, and all railway companies, is to strictly observe all public obligations and to trust the public to be equally just in its treatment of corporations.

According to the report of the Illinois Bureau of Labor Statistics, only 20 per cent. of the workmen in that State are employed full time, and 35 per cent. are employed less than half time, or from 13 to 30 weeks in the year. Of the whole number 65 per cent. find work less than 40 weeks out of the 52.

Frost Proof Steam Trap.

Considerable trouble is experienced from the freezing of steam traps placed in exposed situations. A trap exposed to low temperature will freeze after steam is shut off, provided water remains in it, or leaks in. Water will remain in a trap unless an opening is made at or near the top so that air can enter to destroy the vacuum; if water leaks into the trap it will be almost certain to freeze up the outlet, even if the valve is left wide open.

The construction of this trap is such as to prevent the freezing referred to. It is provided with two ample outlets, one in the top, and one in the bottom, with a valve in each automatically controlled by the temperature in the trap body. When steam is shut off the trap rapidly cools, opening first the lower outlet wide, and at 170° or less opening the upper outlet, creating an inlet for air, and thus preventing the formation of a vacuum, and allowing all the water in the trap to fall instantly out. If after this water trickles into the trap from the condensation of the steam remaining in the pipes, and freezes the lower outlet, the upper remains open, and, when steam is again let on, provides for a circulation through the pipes and trap until the lower outlet is thawed and resumes its office, then this upper outlet closes by reason of the increased temperature in the trap.

The operation of the trap is as follows: When cold, both valves are wide open, the stiff spring forcing them from their seats and pushing the flexible surface of the expansion vessel back to its furthest limit. So long as the contents of the trap are cold, the valves are wide open. Steam being let on, all the air and water passes out freely until the temperature in the trap approaches the point at which it is set to close. At this point the pressure in the expansion vessel becomes sufficient to force the valve towards its seat, and thus diminish the flow of water, delivering it only at the temperature at which the trap is set to close. The valve controlling the upper outlet is set to close at 180°, and closes before any steam reaches the trap, thus leaving the lower outlet, which is set at 210°, to control the flow of condensation, either outlet being extra large for any service that may be required of the trap. When steam is cut off from the pipes and the temperature falls 10°, the bottom valve is wide open, letting the water out instantly; and when the temperature falls to 170°, the upper outlet opens, thus providing an inlet for air to destroy any vacuum which may tend to form in the trap or pipes.

If for any reason the lower outlet becomes closed by ice, the upper outlet is wide open, and provides for the circulation (when steam is again let on) until the lower valve is thawed out; the rising temperature closes the upper valve, leaving the lower to take care of the condensed water. By this arrangement a sure circulation is provided under any circumstances. There is no loss of steam at the top, as it is set to close and closes at 180° or less. The inlet area is tapped for 1½ inch pipe, thus providing against the inlet pipe being frozen by the trickling water.

These traps are made by the Curtis Regulator Company, Boston, Mass.

LETTERS FROM PRACTICAL MEN.

Boiler for One Horse-Power.

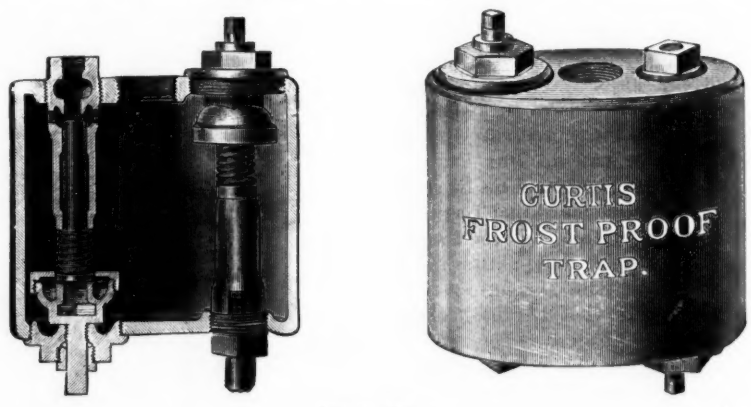
Editor American Machinist:

F. W. asks in your issue of May 28, the size of boiler for one horse-power. I think an upright boiler with 7 tubes 30 inches long and 2 inches diameter would be right. The shell should be 14 inches diameter made of $\frac{5}{16}$ inch iron having a tensile strength of 50,000 pounds, shell single riveted; this would stand 225 pounds pressure.

The fire box should be 9 inches diameter, 24 inches from crown sheet to grate bars. This boiler would have a water space of 2½ inches, from which the mud and sediment could be easily removed.

The smoke stack should be 4 inches diameter, extending from a cone shaped pipe covering the tubes. HENRY MELLON.

Providence, R. I.



STEAM TRAP.

Corrosion or Pitting in Boilers.

Editor American Machinist:

In your issue of May 21 is a communication in relation to this subject. I will try and give you what I know, or more truly speaking, what I do not know. If I had been a writer for the AMERICAN MACHINIST twenty-five years ago, I could have spoken with more confidence, as I had at that time certain pretty well defined theories, which time and extended observation have made rude holes in.

In the old-fashioned steamers, carrying 10 pounds steam pressure, using jet condensers feeding sea water or lake water into their boilers, such a thing as inside corrosion below the water line was not known. As we well remember, the surfaces were thoroughly covered with carbonate of lime in the lake boilers, and with sulphate of lime in the sea-going boilers, so that if there was any tendency toward corrosion it was thoroughly prevented by this mineral deposit, varying from $\frac{1}{32}$" to 1" in thickness.

The salt being very soluble gave no trouble, as by blowing off a half, or a third, or a fourth of the water fed in, the percentage of salt in the water did not become too high.

The sulphates and carbonates of lime being insoluble in hot water and pretty good non-conductors even when wet, acted to reduce the steaming powers of the boiler, and great attention had to be paid to making the interior very accessible for the scaling tools, and these conditions meant wide water spaces, few stays, and low pressure steam. Furthermore it was found that the higher the steam pressure, the greater was the lime deposit, and this independent of the amount of the blowing off, or as some said, the greater the amount of sea water running through a boiler, the greater was the deposit. To prevent this lime deposit, and to save the loss of heat consequent upon blowing off, surface condensers were proposed and some were fitted in ships of the United States Navy about 1858. One of these, the "Wyoming," built at Philadelphia, had a condenser, which, though different in detail from those now in use, had the distinguishing feature of brass tubes cooled with sea water on one side, and allowing the exhaust steam which was condensed on the opposite surface to be kept separate from the sea water, and furnishing a feed of fresh water for the boiler. Losses by leakage were, as now, made up by using sea water.

On the first cruise of the "Wyoming" to and in the Pacific the fun began. One of the engineers noticed a slight stream of water playing from the boiler front, and on tapping it lightly with a hammer with the idea of stopping the leak, it became a round hole the size of the finger. This was plugged with pine; more holes and more pine plugs followed, until it was feared that the boiler fronts would come out altogether, before the ship could make San Francisco.

In the war time, and since, all the ships built from the designs of the United States Navy Department were fitted with close tube surface condensers. The boilers of the ships whose duty was principally blockading, with heavy fires all the time, and with large amounts of sea water ran through them by feeding and blowing, so as to prevent blowing off the steam above decks when the engines were standing, became heavily scaled; and such a thing as corrosion was not thought of. The ships making long and continuous runs, in many cases had their boilers somewhat corroded, and no hard scale was formed. The steam pressure in these boilers was from 25 to 35 pounds.

Various theories have been proposed to account for the corrosion. First, that the condenser and boiler, and the connecting pipes, form a great galvanic circuit. Second, that particles of copper or brass are carried into the boiler, each particle producing local galvanic action. Third, fatty acids, produced by the decomposition of the animal oils used in the cylinders, which, not being pumped overboard, as by the old jet condenser system, but into the boiler, produced the effect, either by themselves or in combination with the copper. Fourth, the use of steel in boiler construction, and an assumed difference in its chemical constitution. Fifth, high pressure steam, and, consequently, high temperature of the water in the boiler.

To examine the different theories in the order in which I have stated them:

First. While it may or may not be true that the condenser and boiler form a galvanic couple, it is a fact that boilers using pure pond water, and having no condensers or other brass appendages whatever, are frequently corroded as much as any marine boiler.

Second. With a view of preventing the particles of brass from passing into the boiler, condensers were and are very often tinned. The tinning is of no value whatever for preventing corrosion of the boiler so far as I have observed.

Quite recently I proposed this theory to a company doing a large business in casting and manufacturing brass goods; the boiler—a small upright—had been corroded to leakage. It was fed from an open tank, and my assumption was that particles of brass had found their way into the tank and into the boiler. I was informed that the boiler alongside of it had been in use twice as long, and no signs of corrosion had been developed. I found, however, that the corroded boiler was but rarely used under steam, but stood with water in, ready for use.

Third. Petroleum oils have been substituted, and are now almost entirely used in cylinders, and the corrosion goes on. In the steam fire engine mentioned by your correspondent all the oil used in the cylinder is fired up the smoke pipe along with the exhaust, and consequently can do no harm inside his boiler.

Fourth. The case of the old "Wyoming's" and many other boilers, built long before boiler steel was known or thought of, ends that theory.

Fifth. The "Wyoming" carried fifteen pounds, which I consider is not high pressure, and in the case Mr. Tuttle describes the pressure for the greater part of the time did not exceed the atmosphere.

Mr. Tuttle's theory is as good as the others until tested by actual experiment, but he gives in his letter a very useful fact, which I am very glad to know, and that is, that the steam fire engine boiler had steel tubes. There are in the city of Boston a large number of Amoskeag engines which have copper tubes in their boilers. I have observed that these boilers rarely last more than four years, the steel being pitted or corroded through on the lower tube sheet, and on the shell from the top of the furnace to the water line. The engines are kept standing with hot water in them, ready for an alarm the same as described by Mr. Tuttle. Now, until I read his letter I supposed that the corrosion was due to the copper tubes, but it appears that I am mistaken again.

The only theory which I can formulate in view of all these facts which I have stated is this: Water, whether salt or fresh, is a solvent for most metals. Some metals are more readily dissolved than others. Thus zinc is more readily dissolved than iron, iron than lead, lead than copper, copper than tin, etc. Metallic solutions appear to be assisted by heat, while solutions of sulphate and carbonate of lime in water will precipitate, or throw down the lime on being heated. Under this theory all boilers must be corroded wherever the water has access to their metallic surfaces, and it is only the accidental fact that those metallic (clean iron) surfaces are covered with their own oxides (rust and scale) or with the carbonate of lime in fresh water, or carbonate and sulphate of lime in sea water, that they endure at all. Wherever clean iron is exposed the action seems to be intensified, and when the water is particularly pure and soft—that is, free from lime, as is the Boston—we find greater corrosion.

When a boiler is in use, making a large amount of steam, and fed with fresh water or sea water, the precipitation of the lime on the surfaces tends to protect that boiler. If, however, the feed be distilled water, from a surface condenser, corrosion must take place because of the absence of the lime. The experienced sea-going engineer by using a very large amount of sea water, and blowing off the surplus, though not to so great an extent as in the old jet condenser days, tries to maintain a scale in his boiler for protection against the action of the distilled water of his condenser. Some attain some success in this direction, others do not.

When a boiler stands with soft water in it the action goes on unchecked on the clean metallic surfaces, as in the steam fire en-

gines. Vegetable extracts have been proposed, which, fed into the boiler, will coat and protect the surfaces. Vegetable extracts, however, if fed into a steam fire engine boiler, will produce foaming, which will last as long as the extract does, so that they will not do for Mr. Tuttle.*

The thing which I propose, and I do it modestly, is to remove a few tubes, say six, and in their place put round bars of zinc, made true and straight by turning to fit the holes in the tube sheet, and bead the ends over the same as a tube. When they are in place, the corrosion will take place on the zinc, and not on the steel. After a year, let one be taken out and examined, and its condition reported to the American Machinist. The theory is based upon the electric or galvanic action. I have immersed bright sheets of steel in sea water, having a piece of zinc riveted to one end, and so long as the zinc lasted the steel was practically unaffected; but so soon as the zinc was gone, corrosion took place rapidly.

It appears to be necessary that the electric circuit be complete; otherwise the action will be imperfect; for I have known of a sea-going ship in which pigs of zinc were used up by the ton, without in any way apparently checking the corrosion. They were simply loaded in through the man-hole.

William H. Harrison.

Braintree, Mass.

Running by Air.

Editor American Machinist:

No, an engine cannot be run by vacuum when the exhaust pipe is connected to the condenser of another engine, even with the advantage offered by Mr. Kent, that is, by having the steam chest removed or open to the atmosphere. The reason is that no air pump of suitable capacity or design is built to exhaust the air sufficiently to form a good vacuum.

To me there is nothing surprising in the instance of the engine of the Chicago.

I recently saw a non-condensing engine running full speed with the throttle closed, and the engineer had to close a valve next the boiler before the engine could be stopped.

It is not right that young engineers should be incorrectly informed in this matter. It is on a par with something which I at one time saw. An engineer (so-called) had a new fly wheel one-third heavier put on an engine, and found that the same work was done with a saving of one-third of the fuel!

Subscriber.

Running on Low Pressure.

Editor American Machinist:

In view of what has been said in your columns on running an engine without steam, the enclosed cards may not be uninteresting. They are taken from a 30″×60″ Corliss engine, fitted with a regular lifting air-pump; the engine is used to drive eight pairs of rolls for rolling brass.

The cards were taken with a Thompson indicator, 30 spring.

When the rolls become worn in the center they are turned down on the ends, and for doing this the engine is run very slow, with the throttle nearly closed.

No. 1 is a card taken under this condition.

No. 2 was taken after the throttle had been tightly closed, and the cut-off had just ceased to act. On this card the lines are reversed, the bottom line being the steam line, or from the steam side of the piston, and the upper line the exhaust or side open to the condenser. This is caused by the cylinder being a better air pump than the air pump proper. The cylinder being 6½ times larger than the air pump, when the engine is running fast, the vacuum, under the conditions named, will be nearer perfect back of the piston than in front of it, or towards the condenser.

W. E. Crane.

Waterbury, Conn.

[The diagrams to which our correspondent refers show no pressure above the atmosphere. In that to which he refers as No. 1 the upper, or steam line begins at 6½ lbs. below atmosphere, running down to 10 lbs. below atmosphere at the end of the stroke, while the average back pressure line is about 11 lbs. below atmosphere.

In No. 2 the throttle was closed, and, as Mr. Crane says, the steam line was lower than the back pressure line, the motion being kept up for the time being by the inertia of the fly wheel. This is exactly what might be expected with a tight piston, and steam ports as ordinarily proportioned. It represents negative work, which would result every time an attempt was made to run an engine with exhaust connected to condenser and no pressure admitted to move the piston.

A Court for Defense of Patents.

Editor American Machinist:

In your issue of May 28th, under the head of "The United States Patent Laws," I see a communication from Mr. Perkins which I hope will be thoroughly criticised and debated upon, before a remedy is petitioned for. The grievances he sets forth are only too real, and have been vividly manifested to many a poor enthusiastic inventor to his sorrow. True the "Patent Sharks" should be laid low and the Patent Office scourged and cleansed of the injustice which now stains it, but in doing so should we take a step half a century backward? Should we practically throw away all of the rights of the poor and common inventors, and place him in a hazardous place to be gazed upon, thirsted for, and swallowed by the greedy of greater means and big monopolies? No! the inventors should cultivate their business tactics, and organize, and work together for their protection. There is no doubt that the United States owes in a great measure the elevated position she occupies among the civilized nations of the world to the inventor's brain. How has she reaped so much benefit from these productive brains? By granting to the patentee the exclusive right to make, use, and vend his invention throughout the United States and Territories thereof, for a limited time, and then appropriating the blessing, and scattering its benefits broadcast for the benefit of all.

To most people it is evident that, because of corruption in the Patent Office, and the use of money freely in the courts, the United States has not, in hundred of cases, fulfilled her promise of protection to the inventor. Now, because the rich have an advantage, and can get much that they desire which belongs to their poorer fellow man, does it follow that we should fall back half a century, and place all of these products of thought at their feet, and make them a bone of contention from which the patent lawyer and shark shall have a large slice of the choicest meat? No! If the Patent Office needs cleansing let it be cleansed. If there is not enough ability in the Patent Office to issue a patent that cannot be overruled by the courts, then let the necessary ability and integrity be obtained with the surplus money that the office is turning over to the already overloaded treasury. Then let there be a Court of Defense provided by the United States, and if a claim cannot be sustained which the United States has granted, then let her pay the damages. Invincible documents are granted and sustained by other governments, and by ours for other purposes, and why not for patents?

Walter E. Crane.

Owatonna, Minn.

Moulding Car Wheels—Chilled Tools.

Editor American Machinist:

An article by Mr. R. E. Masters on "Car Wheel Moulding," in your issue of May 28, goes to show that at least a part of the mechanical world does not know what the rest are doing. We were not aware, before reading the article referred to, that we were in any way ahead of others in the same line of business, but it seems that old ideas that we did away with a long time ago are still in use in some parts of the country. And for the benefit of those that are still in the old rut we will explain how we do it now. We use the fillited core, as shown by Mr. Masters, and we pour through the center core, which is made the same as any other, with a 1½″ center hole, and four ⅝″x1″ gates, just half way between the webs of the wheel. We first tried pouring at bottom, as mentioned by Mr. Masters; but it is not as good a plan as the first mentioned, on account of the liability to shrink inside of hub. Since adopting this plan we very seldom have a wheel that cannot be bored, or one that requires chipping; and we get a clean, smooth hub on both sides of wheel every time. Mr. Masters speaks of steel cutters that cost $1.00 each. Well, we never use them—could not afford it, and would not use them if we could, as long as we can make a chill cutter for 10 cents that will bore a wheel that a steel tool will not touch. Grinding chill tools on an emery wheel does not injure them in the least. We also use chill tools for turning axles, not because they are cheaper, but because they are better.

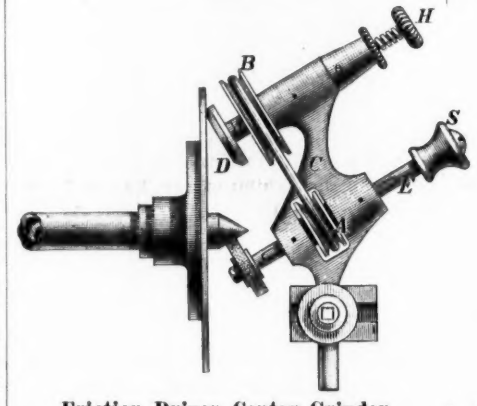
C. H. & P.

Lead in a Cupola.

Editor American Machinist:

The object in putting a piece of lead into a newly-daubed cupola will be understood from the following: The only heat that the bottom of cupola can get previous to the melting of the metal is the heat it receives while blowing through the tap-hole. Now, if this be not sufficiently done, the first metal that falls after the tap-hole is closed will be chilled, causing much trouble in tapping out. To mitigate this trouble a piece of lead is thrown into the cupola, which immediately falls to the lowest point, which is the tap-hole, where, by reason of its low melting temperature, it remains fluid, and being the heaviest, it repels the iron, thus facilitating tapping out.

Wm. Golding.



Friction Driven Center Grinder.

Every lathe hand knows that it is quite a job to turn up lathe centers true, because the quick speed necessary when turning up the joint is too quick for turning up the large end. It is also difficult to turn them up straight and smooth. Most men finish them by filing. No matter how fast the lathe runs, or how careful the man is, he cannot file them so they will run dead true, and they will be out of round, causing the dead center to wear the working center away.

By using a center grinder the centers can always be kept true and round. This grinder has no belts to be attached, and all the running bearings are covered so that the fine emery cannot cut them away. The hub of the shive pulley *B* runs in the frame *C*. The friction wheel shaft *D* slides in and out of the hub of shive wheel *B*. The shive wheel *A* is fastened to a sleeve in which slides the emery wheel spindle *E*. The wheel is moved in and out by the knob *S*, which is made so that it does not revolve with emery wheel spindle. The friction wheel has a rawhide face. It does not require to have the friction wheel forced hard against the friction plate. It might be assumed that considerable pressure was required, but a very slight pressure is sufficient. There is an abundance of driving power in the friction; in fact, materially more than is required.

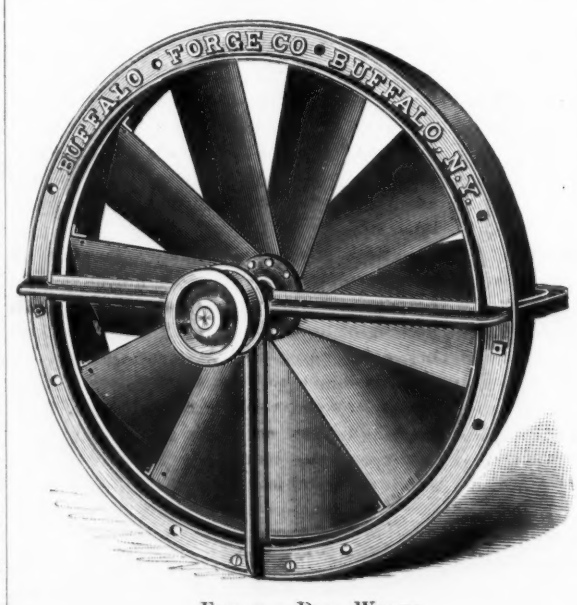
For attaching this grinder it is only necessary to fasten the friction plate to the face plate by drilling and tapping two ¼ inch holes in face plate, put the grinder in tool post the same as a turning tool, set it to the proper angle by moving emery wheel along the center, lock carriage on the screw and bring friction wheel against friction plate. The thrust screw is to adjust friction wheel for long or short centers.

These grinders are made by the Energy Manufacturing Company, 1,123 South 15th street, Philadelphia, Pa.

The Buffalo Exhaust Disk Wheel.

In the construction of this wheel the mechanical principle of the inclined plane is applied to the movement of air. The vanes of the fan are curved to an expanding pitch, so as to cut under the body of air rather than to move it laterally, or carry it in a body with the wheel. This it is claimed more easily overcomes the initial inertia of the air. The peculiar construction of the vanes tends to deflect the air outward, an effect which is supplemented by the cone-shaped case having larger outlet than inlet, whereby the air is induced to follow an easy curve in one direction throughout, thereby not only reducing the friction in its passage through the fan, but avoiding all eddies or jackets of fixed air inseparable from the employment of ordinary fans.

The vanes and outer shell of fan are made of rolled sheet steel true to gauge. The journals are phosphor-bronze with automatic oilers, and the entire wheel is accurately balanced. All parts are made to scale, and any part broken by accident or otherwise may be replaced.



Exhaust Disk Wheel.

The fans are especially adapted to the removal of air, gases, steam, etc., where volume is desired rather than pressure; such as removing gases, smoke, steam, acid fumes, moisture and vitiated air from blacksmith shops, furnaces, foundries, engine rooms, drug houses, paper mills, woolen mills, dye houses, tanneries, etc., etc.

The manufacturers are the Buffalo Forge Company, Buffalo, N. Y.

Plans have been filed for a new railroad between New York and Boston, upon which it is claimed the time between these two cities will be shortened by two and one-half hours. We wish success to the enterprise. It is a long way, reckoned in hours from New York to Boston. It ought to be shortened.

The New York Electrical Society and the American Institute of Electrical Engineers propose to have an exhibition of electric appliances in New York next fall.

Fifteenth Meeting of the American Society of Mechanical Engineers.

The meeting convened in Willard Hall, Washington, D. C., on Tuesday, May 31, 1887, President Geo. H. Babcock in the chair. The attendance was larger than at any previous meeting since the society was organized, the secretary having received advance notice that over 325 persons, including ladies, would be present. The number of ladies in attendance was greater than on any previous occasion, and their presence was a very agreeable feature of the proceedings. The continued growth and prosperity of the society was well evidenced by every session, in a way that could not prove otherwise than gratifying to all present, and especially so to those who took part in the meeting for preliminary organization.

Mr. Webb, president of the Board of Commissioners of the District of Columbia, welcomed the membership to the capital of the nation, in an appreciative address. He felicitated the men he saw before him, on the mechanical achievements which were their happy privilege, feeling that in the presence of men of their stamp he was unworthy to essay more than the merest words of welcome. He referred to the wonderful progress of steam engineering, and said the steam engine had long since quitted the regions of science, and had become one of the household appliances of mankind. He spoke of the increasing importance of the place held by mechanical engineering in the advance of civilization. Among other achievements, it has enabled us to converse with distant nations as easily as a housekeeper may with her domestics. None can tell what the future holds in store. The world is young, and none can predict the goal that science will one day reach. Men such as he saw before him have taken up the task of adapting the material resources of the world to the use of mankind, in a way akin to philanthropy, and with the effect, by devices that are growing constantly more easy and familiar to them, of adding new zest to human life. He said: The whole world looks to you and such as you, and your best reward is the benediction of every good man.

President Babcock responded in fitting terms on behalf of the society. He said they were glad to come from the rumble of shops, the clatter of hammers and the confinement of the drawing board, for a season, to enjoy the beauties of nature and art in the capital city. Americans generally are not as well aware of the beauty of Washington as they should be, and do not appreciate it as they ought. The bitter partisanship that sees only evil in whatever is done by its opponents, the would-be criticism that only truly enjoys the flavor of decay, and the ultra-worship of foreign ideas that finds nothing to admire, except it carries a congenial trademark—all combine to prevent Americans from fully appreciating the streets, avenues, buildings, monuments and other glories of Washington, including the most magnificent capitol in the world.

At the conclusion of the president's remarks the report of the Committee on Uniform Tests was called for, and Mr. Towne responded, on behalf of that committee. Much work has been done by them, but the committee are not yet in readiness to make an effective report. Several distributions of materials have been made to manufacturers and establishments having facilities for making tests, and replies from about fifteen have been received. But the method of making these replies differs so widely, notwithstanding the issuing of carefully prepared blanks, that the committee propose a further revision of the system employed in the work of inquiry. Such revised reports as have latterly come to hand contain the promise of more satisfactory results, and it is hoped that this lack of comparability will be finally overcome, and that a report can be submitted to the society for substantial action at the next meeting.

The concluding report of the Committee on Standard Pipe and Pipe Threads, the greater part of which has already been published in connection with the proceedings of the last meeting of the society, being called for, Mr. Bond, on behalf of the committee, said their work had reference to special pipe, such as pipe for gas and salt wells; also special pipe for the conveying of natural gas and petroleum, other than that covered by the Briggs standard. Also a standard for brass pipe which is not included under the new standard. We give this report below.

The report as agreed upon in New York, May 25, 1887, was accepted, and the committee discharged.

The report of the Council acknowledged in fitting terms the generosity of S. W. Baldwin, a member of the society, in purchasing and presenting to the organization, the large and valuable collection of mechanical and scientific apparatus formerly owned by the late J. C. Hoadley. The list as read comprises five different classes of instruments and appliances. The report also says there is now to the credit of the Library Fund about $1000. The canvass of the votes cast during the election just past shows an addition of 60 new names to the membership rolls, 49 being members, 6 associates and 5 juniors. The total membership in all classes now comprises nearly 800 names.

The regular committee to nominate officers was appointed by the chair, consisting of H. A. Ramsay, of Maryland, Thos. J. Borden, of Massachusetts, Wm. H. Weightman, of New York, F. H. Underwood, of Connecticut, and Wm. H. Doane, of Ohio.

Various requests and invitations were read, one being an invitation from John D. Ford, principal of the Manual Training School, Baltimore, to inspect the operations of that institution, and another being a communication from John W. Weston, Commissioner General for the United States, asking to have the society represented at the Paris Railway Jubilee or exhibition of Railway Appliances, either by models or delegates. Mr. Towne in reference to the latter request said Gustavus C. Henning, a member of the society, was now in Paris, and would be in charge of the exhibit of the Yale & Towne Manufacturing Company, at that Exhibition.

Concluding Report of Committee on Standard Pipe and Pipe Threads.

At the Washington meeting of the American Society of Mechanical Engineers the following final report was read and accepted, and the committee discharged:

GENTLEMEN: Your committee, to whom was referred the consideration of a standard for pipe threads for purposes other than that which is covered by the Briggs formulas and tables, the consideration of which, with results, is contained in the report of your committee presented at the seventh annual meeting of this society, have the honor to report the following conclusions:

At a meeting of your committee held in New York, Wednesday, May 25, 1887, at 11 o'clock A. M., the advisability of attempting to standardize pipe and pipe thread sizes for thin brass tubing, oil and salt well casing, and special tube for oil, natural gas and other pipe lines, was carefully discussed, and your committee would respectfully report that, as pipe for this class of work, is of a character which might properly be termed "special," and not a product of universal application in the trades, as is pipe which is covered by the Briggs standard, your committee are of the opinion that the consideration of the matter, and the action necessary in order to harmonize the various pipe thread sizes for this class of work, properly belongs to the manufacturers and users of this special pipe, rather than to your committee.

Your committee would further say, that while the Briggs standard covers in its application the sizes of pipe and pipe threads for purposes in which every engineer, manufacturer, and consumer, in the country is more or less deeply interested, and while uniformity is certainly a necessity for the various special pipe thread sizes for oil and salt well casing, pipe line and thin brass tube, also for the couplings and fittings for fire engines and water work connections, and that such a desirable result should be brought about with as little delay as possible, still, as already stated, it would seem to your committee to lie entirely in the hands of the manufacturers and the consumers of such pipe and tube.

The advantage and the convenience of an interchangeable system, which should include the results of intelligent experience, is unquestionable, and your committee would earnestly recommend the matter to the attention and consideration of the manufacturers of this special tube and pipe.

Brass tube for steam and water pressures is now made of sufficient outside diameter and thickness to permit the thread being cut to the Briggs standard, and is the practice in New York for all sanitary plumbing, and for steam and hot water wherever brass tube is used for the purpose.

Your committee would also state that brass and iron fittings for thin brass tube, such as would not permit the application of the Briggs standard thread, are not carried in stock by the fittings trade, brass tube of this kind being special and used only to a limited extent for elaborate sanitary or ornamental work, and on which tube a finer thread is necessarily cut, often no thread whatever, soldered joints being used instead. This shows conclusively that thin brass tube of special size and thickness is not a product in universal use, and hence is not to be considered by your committee in this connection.

In conclusion, your committee would also state, that although there is made and used an enormous quantity of oil and salt well casing and pipe line tube (referring to the latter only in sizes on which a special thread is cut, other than the Briggs standard) and great as is the desirability of a standard uniformity in sizes to thus ensure practical interchangeability for this product, yet the use of this class of tube and pipe is in a certain sense local, and not of universal application, and does not, in the opinion of your committee, come within the province of the work of the society, but should be carefully considered by those whose interests are directly concerned, the members of this society, individually, aiding in every possible way their efforts to accomplish the desired result.

FREDERICK GRINNELL, Chairman.
GEO. M. BOND, Secy.
B. H. WARREN.
WM. J. BALDWIN.
GEORGE SCHUHMANN.

WASHINGTON, D. C., May 31, 1887.

The Strong Locomotive.

The *Wilkes-Barre Record* has this to say of the tests of the Strong locomotive:

The tests that have been in progress for some time on the Lehigh Valley Railroad were wound up yesterday with a run up the mountain on train 5, leaving Wilkes-Barre at 1 P. M., with locomotive 444 and eight cars, one of which was the dynamometer car of the Pennsylvania Railroad Company. By the latter the pull of the locomotive, the time on every part of the road and a complete record is taken. This train left Wilkes-Barre nine minutes late, and went to Glen Summit eight minutes late, making the run from Sugar Notch to Fairview, 12 miles of 96 feet grade, in 24½ minutes, with one slow-up on account of cattle on the track. This is the heaviest train by two cars, or 25 per cent. in weight, that has ever been pulled up this grade at this speed. The engine was fired with soft coal and was almost smokeless, and had full pressure of 155, at which point she was blowing off, part of the time while being worked the hardest, nearly at the top of the mountain. This is considered by experts to have been the best run ever made by a locomotive at heavy express work, and it is doubted whether there is another locomotive now running that is capable of doing so well. This engine came from White Haven to Glen Summit on Thursday with nine cars, doing the 10½ miles of 68 feet grade, in 19½ minutes.

It is said that a small amount of sawdust between the circular saw table and a heavy plank will render the hauling the latter comparatively easy, as the grains of sawdust act as small rollers and reduce the friction.

Next Meeting of the Institute of Mining Engineers.

According to prospectus issued we learn that the Forty-eighth Meeting of the Mining Engineers will be held in Utah and Montana, beginning at Salt Lake City on Wednesday evening, July 6. The Chicago headquarters are the Sherman House, from which members will leave by the Chicago, Burlington and Quincy railroad, July 1, at 12.30 P. M. The prospectus referred to says:

This excursion will be personally conducted by an experienced manager from the traveling agency of Thos. Cook & Son. The price to each member of the party, including railway fare, Pullman sleepers, meals, first-class hotel accommodations, etc., from the time of leaving Chicago to the time of arriving at Duluth, will be two hundred and sixty dollars ($260).

Application for places must be made to Thos. Cook & Son, 261 Broadway, New York city, accompanied with a New York draft or postal order, payable to them, for $25 for each person. They will at once return a "deposit receipt," securing the place of the applicant. The remainder of the total price, viz., $235, must be similarly remitted to them, at their New York Office, on or before June 25, when they will forward tickets, etc.

Persons wishing to join the excursion at Denver or Salt Lake should make application and remittance of $25 as above, and will be informed by Messrs. Cook & Son of the reduced price at which they can secure places.

This excursion is open to ladies accompanying members or associates; to the families of members or associates; and to persons proposed for election as members or associates, and ladies accompanying them.

The detailed programmes of sessions, etc., at Salt Lake and Butte will be arranged by the local committees at those places. Letters of inquiry on these subjects may be addressed to Mr. Joseph R. Walker, Salt Lake City, or Mr. C. W. Goodale, Butte, Montana.

The Forty-ninth Meeting of the Institute will be held at Duluth, Minnesota, beginning Tuesday evening, July 26. The detailed programme of this meeting will be either communicated in a later circular from this office, or handed to members on their arrival at Duluth. At present it can only be said that there will be—besides the hospitalities and pleasures of Duluth and its harbor—excursions to the Vermilion and Gogebic Mines. Letters concerning this meeting may be addressed to Mr. R. S. Munger, Duluth, Minn.

In view of the result of the above arrangements, in bringing together the two meetings usually separated by several months, there is danger that the number of papers to be included in Volume XVI. of the Transactions may fall below the usual average. Members are earnestly requested to prepare papers for one or the other of the meetings announced in this circular. In actual reading of papers preference will be given at each meeting to those which are descriptive of local mines, works or practice; and members residing in or familiar with the mining districts of Utah and Montana, or with the iron ranges of the lake region, are specially urged to prepare such papers. If necessary, time can be allowed after the meeting for perfecting the manuscript for publication. All members intending to have papers presented or read by title at either of the meetings are requested to inform the undersigned at once.

The Graham prison labor bill which we alluded to last week as having passed one branch of the State Legislature was not put upon its passage in the Senate. By concerted action of both political parties it was just "two minutes late," the Senate adjourning before reading it. Refusing to meet this issue with the people was one of the most cowardly acts of the retiring State Legislature.

The Rand-Avery Company, Boston, has voluntarily announced to its employes that on and after June 1 the price of piece composition will be advanced to forty cents for the men and thirty-two cents for the girls, and that during the months of July and August the office will be closed at two o'clock Saturdays without loss of pay.—*Manufacturers' Gazette.*

What we are anxious to know is why the girls get 20 per cent. less pay than men for doing the same work? There seems to be an opinion, based upon injustice, that a woman doing the same work as a man should receive less pay for it. We do not believe this is right.

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NEW YORK, JUNE 18, 1887.

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Establishing Manufacture.

Formerly when a manufacturer was desirous of establishing himself, he found out about all he knew of different localities by personal observation. Nowadays unusual inducements are offered for the location of manufacture, and a prospective manufacturer can remain at home and learn everything that is favorable in reference to most of the young cities and towns. The unfavorable features, if there are any, he must seek out for himself.

Older localities have lost in growth, or ceased to grow altogether, in a manufacturing sense, either through failure to comprehend the true significance of the change in business methods, through lack of energy, or sometimes perhaps through false pride in not helping their light to shine. A large share of selling is done nowadays from personal application, not of the man who wants to buy, but of the one who wants to sell. So it has come about that those towns and cities who are the most alive to the advantages of establishing large manufacturing interests not only offer the best inducements, but they take the most pains to let their offers become known to those likely to be interested; in a word, the application is on their part, and they secure most of the trade.

It is not worth while speculating as to whether this is good or bad practice; it is a fact that it is the practice, and when a town or city, except in the instance of a few universally known manufacturing centers, is desirous of promoting manufacture they must be governed by this fact if they expect to succeed.

Many times a locality new to manufacture may be the very best place in which a manufacturer can start in business, but it is not sure to be the best simply because he is the first to start there. On the contrary, those who go a long way from home for this purpose not infrequently find the proverbial crooked stick. The subject is always worthy of careful consideration, but it does not always receive it. Sometimes goods made a long way from trade centers must be shipped back for sale at an expense greater than the difference in the cost of manufacture; and this difference in cost may be over-estimated. Where highly skilled labor is required it may be difficult to get and keep it in places out of the way so far as that kind of work is concerned. We have just heard of an instance that very fairly illustrates this. One year ago a large manufacturing concern moved from New York—their natural headquarters—nearly two hundred miles away, the idea being that labor would cost them materially less. To-day we are credibly informed that they are paying mechanics 15 per cent. higher wages than they paid in New York, and cannot get the class of workmen they want, and need, at that. The superintendents and foremen, finding the worry and trouble of getting along with men unused to the kind of work they do to be unbearable, cannot be induced to stay in the new location.

The above is of course but one side of the question. Contrary to this, in some manufacture where highly skilled labor is not required it may be more easily obtained where there is little demand for it; or in the more skilled trades the prospects for general growth may be such that it will not be difficult to keep the requisite supply. One thing, however, may be taken for granted; that is, that skilled workmen of the best kind will not be found where there is only one establishment employing that kind of labor; and in this the workmen are prudent and wise.

A Word About Patents.

We recently heard an amusing instance of a man in charge of quite extensive works, who refused to consider the advisability of using a labor-saving machine because it was patented. It brought to mind the fact that there is a considerable number of people who object to buying patented devices for various reasons that have but little weight. When practically compelled to buy, they do it with an undefined feeling that somehow they are swindled out of part of the purchase money.

It is very generally assumed that a much greater price must be paid for a patented article of any kind than for one that is not patented. This is sometimes true, and in isolated instances, perhaps, glaringly so, but it is not true in the sense of being universal or common. It is entirely safe to say that, as a whole, patented articles of manufacture are materially cheaper than they would be if the inventions relating to them had been made just the same, but no protection had been given the inventor. In other words, the great majority of patents granted and worked serve to cheapen the cost of the manufactured article to the user. In a comprehensive way the statement so often glibly made, that the inventor, by virtue of a patent, is protected in taking money from others' pockets, is far from being true.

Let the article to be manufactured be one of common use; the inventor, understanding that his rights are reasonably secure, makes plans for manufacturing cheaply; upon this basis he can interest others, if necessary, in the investment of the capital required. Were this same article common property the chances always are that the cost of manufacture would continue to be twice what it is under the protection of a patent, and the selling price nearly in the same proportion higher for years at least. Without the certainty of controlling large manufacture men will not be found, except in rare instances, willing to put the necessary money into the manufacture. The profit the inventor receives is, nine times in ten, derived from better facilities for manufacture, made possible only through the protection accorded him, the public at the same time getting the greater part of the advantages of these facilities.

If those who honestly believe that patent protection increases prices will look at the thousand and one little conveniences in every-day use, stamped with the word patented, and which are sold at prices so low that it seems incredible that it shall cover the cost of production, the chances are that they will find occasion to modify their opinions.

There are, undoubtedly, instances in which a patent is made to cover unjustifiable monopoly. But this is only another verification of the fact that no law is, or can be, perfect in its working. The patent law does not cover one-tenth the monopoly that is covered by other laws, or in fact that exists without warranty of law, or in spite of law.

There may be things in the patent law that need reforming; this is true of nearly every law. But the reformation recommended by some—reformation that would practically make it a dead letter—would be the height of unwisdom. The fact that manufacture has attained the proportions it has attained in this country is largely due to patent protection.

The danger of fogs to ocean travelers is being illustrated by much more than the usual number of collisions lately, sometimes attended with loss of life and jeopardizing the lives of thousands. Some inventive genius ought to be able to devise means of judging direction of sound so that two great steamers like the Celtic and Britannic should not come into collision in mid ocean with their whistles sounding at frequent intervals.

We see it stated that the boilers of the nail mill at Fall River are being taken out and sold for old junk, the mill having permanently ceased operations. This is a novel use to put old boilers to. They are usually taken out, painted, and—just like a trap—set again.

The plea is made against the Massachusetts law compelling railroads to pay once a week that it puts them to considerable expense to run their pay cars once a week instead of once a month. The same argument could be used in favor of yearly instead of monthly payments.

The fact that Graff, Bennett & Co., Pittsburgh, iron manufacturers, have been able to pay off an indebtedness of a million dollars for which they got an extension from their creditors four years ago is used as an argument that there is still some profit in the iron business.

The *Mail and Express* has printed as much against boycotting as practiced by workingmen as any other paper in the country, to all of which we take no exceptions. But when it publishes the following without a word of condemnation, it looks decidedly as if it made a distinction between sauce for the goose and the corresponding condiment for the gander. If this is not boycott, then we do not understand the significance of the term as used in this country. We are not upholding the boycott, but we make a plea for consistency:

"The Chicago Coal Exchange consists of the miners and agents, wholesalers and retailers of hard and soft coal in Chicago. At the last regular meeting twenty-three members were expelled for non-payment of dues, and at a special meeting last night a resolution passed forbidding wholesalers to sell coal to those expelled. The result is that the expelled men will be unable to continue business unless they come again within the fold."

Literary Notes.

MANUAL OF SCREW-CUTTING COMPLETE Fourth Edition. Illustrated. Containing rules for calculating the change gears on screw-cutting lathes to cut square and angular threads per inch or per pitch, with two or four gears. Also useful rules for calculating the diameters and speeds of pulleys. By William Simpson. Boston. S. Woodberry & Co., 105 Summer street.

In this little book the author sticks closely to his text, and treats the subject in a thoroughly "shop" manner that will be appreciated by those who want light on the subject. He not only tells how to gear up for cutting screws, and how to calculate the size of pulleys for different speeds, but contrives, in the small compass at his command, to give tables worth twice the price of the book. It costs 20 cents to buy this book in paper cover, and 30 cents in cloth.

The *Stevens Indicator*, for the quarter, contains a number of articles of interest to mechanics and engineers. Amongst these we notice one on "Frictional Resistance of Small Cars," which contains valuable information of a practical character. Another paper on "Water Rams in Steam Pipes" is equally practical in its character. The *Indicator* is published quarterly by the alumni and under-graduates of Stevens Institute of Technology, Hoboken, N. J., at the small price of one dollar a year, or thirty cents for a single number.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(259) H. C. B., Harrisburg, Pa., asks: When cutting threads on gas pipe, should the gauge be placed against the taper, or should it be held parallel with the ways? *A.*—Parallel with the ways.

(260) J. J., Memphis, Tenn., writes: I desire to obtain information as to the process of making malleable iron castings. Can you direct me as to how I could obtain the information? *A.*—See AMERICAN MACHINIST, August 4th, 1883.

(261) G. H. S., Trenton, N. J., asks: 1. What steam pressure would be required in an engine of 1¼-inch bore, 2-inch stroke, making about 350 revolutions per minute, to drive a boat 14 feet long, 2 feet beam and 4 inches draft, at a speed of about 4 miles per hour? *A.*—About 150 pounds per square inch. 2. How many square feet

of heating surface would be required to furnish steam to the above engine? *A.*—About 30 square feet.

(262) Question and Answer 245 (June 4) became somehow disarranged. The question was "What is the benefit of putting a piece of lead in a newly-daubed *ladle?*" Mr. West wished to be understood as saying that he was not aware that it was of much benefit; that possibly the lead would make the iron more liquid if thrown into it; it might in some degree counteract the cooling effect of the "boiling of iron," which might occur in a newly-daubed ladle that was not hot and thoroughly dry.

(263) G. W. B., Napa, Cal., writes: I have an endless 16″ double leather belt which is liable to be wet by the overflow of the river at any time during the rainy season. Can you tell me of a preparation that I can put on this belt quickly that will not injure it, and will protect from the water for six or seven hours, thereby avoiding cutting the belt, which I would otherwise have to do? *A.*—We do not know of anything that will keep the belt from serious injury under the conditions named. Better remove it.

(264) A. W., Branford, Conn., writes: Please inform me as to what gauge small taps are made. I have a number of sizes as follows: 6-36, 8-32, 10-24, etc. What is the difference in the sizes of the diameters 6-8-10, etc.? These diameters do not correspond to a wire or a drill gauge. Are these taps made to the thousandths of an inch? *A.*—The figures 6, 8, 10 indicate the diameters of the taps, and are made to a wood screw gauge adopted, and we believe first established by the American Screw Company, Providence, R. I. The figures 36, 32, 24, etc., are the number of threads to the inch.

(265) G. E. B., Conn., asks? 1. Which form will make the strongest mast for a derrick—a round or a square one—both of the same area and made of wood? *A.*—The square mast will be the strongest. 2. What is the advantage of using a round mast instead of a square one? *A.*—Sometimes the particular design of the derrick may compel the adoption of a round mast, but generally the cost of a square mast is considerably greater than a round mast, because it will require a tree of larger diameter to cut the square mast from than the diameter of the round mast of sufficient strength.

(266) W. P., Petersburg, Va., writes: I know that in a compound engine the high-pressure cylinder takes steam direct from boiler, and exhausts into a receiver, from which the low-pressure cylinder takes steam. Now how does a triple compound engine take steam? *A.*—A triple expansion engine uses the steam first in the high-pressure cylinder, from which it passes to the intermediate cylinder, then to the low-pressure cylinder. 2. I contend that twin screws or propellers are simply two propellers—one right hand and the other left hand, keyed on one shaft. Am I right? *A.*—No. For twin screws two shafts are used. Sometimes one screw is right hand and the other left hand; sometimes both are right hand.

(267) W. E. A., Philadelphia, Pa., asks: 1. Is there a machine in the market to blow grain (wheat, rye etc.) with air, using a pressure blower, such as the Baker or Root blower? *A.*—There is a machine in the market which does blow grain, but we do not know what kind of blower is used; our impression is that an injector is used. 2. Do you think it practical to blow grain in that way horizontally, say, 100 feet, and vertically from 30 to 50 feet? *A.*—We believe it to be practical; care must be taken not to have the blast too strong, as this is liable to grind the grain—an objection we have heard made in regard to machines of this kind.

(268) R. A. P., Romeo, Mich., writes: 1. What size steel would be required to make a coil spring according to sketch? It is to be used as a counterbalance for a crosshead weighing 200 pounds, with a stroke of 24 inches. Inner end of spring to be attached to shaft or stem; outer end to drum 12 inches in diameter. Crosshead to travel down at 17 feet per minute, and back at 40 feet per minute. *A.*—The existing data, by which the strength of and the size of steel for springs of this kind can be calculated, is exceedingly meager, and therefore it is impossible to answer your question satisfactorily. But we believe it is safe to say that the drum in which the spring is to be placed is too small. If you wish to obtain a spring of this kind, the best way to pursue would be to send a drawing of the casing and shaft, and the location in which it has to be placed, to a manufacturer of steel springs, who, on account of his large experience and knowledge of the kind of steel he is using, is the best person to decide the size of steel necessary for the spring. 2. Where can I get a work treating on the strength of springs? *A.*—We do not know; we believe that a book treating exclusively on this subject has not been published.

(269) T. A., Jersey City, N. J., writes: Please settle the following disagreement as regards the subject of percentage in the following problem: In 10,206,417 gallons of a certain liquid there is a loss of 11,550 gallons (say by evaporation). 1. What is the percentage of loss? *A.*—0.113 per cent.? 2. What amount per gallon and what amount per 100 gallons is lost? *A.*—The amount of loss per gallon is 0.00113 part of the gallon, and the amount of loss per 100 gallons is .113 part of a gallon. 3. Is not the percentage of loss the same on 100 gallons as it is on the total amount of 10,206,417 gallons? *A.*—It is the same. 4. As I figure it, the difference is in the amount, and not in the percentage, thus:

$$\frac{11550}{10,206,417} = 0.00113 =$$

percentage of loss. *A.*—Here you are wrong. This answer is not the percentage, but it is the amount lost per gallon. 5. Then multiplying 0.00113 by 100, or $0.00113 \times 100 = 0.113$ = fraction of gallon lost in every 100 gallons, and is not the percentage of loss as claimed by the other party, but is the actual quantity lost in 100 gallons. *A.*—You are right when you say that 0.113 is the fraction of the gallon lost in every 100 gallons, but totally wrong when you deny that 0.113 is the percentage. By percentage is meant "the allowance on a hundred;" if you lose 1 gallon on a hundred, you lose 1 per cent.; if you lose 2 gallons on a hundred, you lose 2 per cent.; and if you lose 113-1000 of a gallon, you loose 0.113 per cent.

(270) A. F., Mt. Olive, Ill., asks: 1. How can I bend small iron pipe for a steam gauge siphon? *A.*—Iron pipe for this purpose can generally be bent without any preparation whatever. If you find trouble in doing this, you can melt rosin and fill the pipe with it, and afterwards melt the rosin in the pipe over a fire and run it out. Or fill the pipe with sand, plug the ends, heat the pipe and bend it; then take out the plugs and remove the sand. 2. Does the pressure of the atmosphere on the top of a lever safety valve make any difference in the correct pressure in a boiler? *A.*—The pressure of the atmosphere is, in round numbers, 15 lbs. per square inch. This pressure tends to hold the safety valve down to its seat. When the pressure in the boiler is 15 lbs. (from vacuum), then the pressure outside and inside is balanced; there is neither bursting nor collapsing pressure on the boiler shell. Hence a safety valve or an ordinary steam gauge shows what it is desirable to know, viz., the pressure that is operative to disrupt the boiler. The only trouble you have in the matter is in supposing that there is no pressure in a boiler until it shows on an ordinary steam gauge, and this has puzzled many a young and some old engineers. As a matter of fact, many light-loaded condensing engines can be run when the steam gauge shows no pressure whatever. This is because the condenser and air pump remove the greater part of the back pressure—*i. e.*, the pressure of the atmosphere. In all calculations pertaining to steam, pressures are reckoned from vacuum; reckoning them from the atmosphere is only a matter of cancellation, and is unfortunate in that it confuses those who ought to know better, but who have gone astray from the influence of popular rather than scientific or sensible considerations. 3. Will a Bourdon steam gauge show a vacuum if the pin is removed? *A.*—Yes; but a pressure gauge is not calculated to indicate vacuum; hence it will merely show that there is a vacuum, but will not measure it. 4. Which would indicate most correctly in testing a boiler—the steam gauge or the safety valve? *A.*—A good steam gauge. 5. Should I put a tightener nearest the driving or the driver pulley? *A.*—That depends upon which pulley the belt is the most likely to slip. Put the tightener on the slack side of the belt, and generally nearest the smallest pulley.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Gear Wheels. See Geo. B. Grant's adv., p. 16.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Edw. Sears, Wood Engraver, 169 William st, N. Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Air Compressors, Rock Drills. J. Clayton, 43 Dey st., NY

Exhaust Tumbl'g Bbls. Henderson B's., Waterb'y, Ct.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Solid Nickel-Seated "Pop" Safety Valves. Consolidated Safety Valve Co., 111 Liberty st., N. Y.

Robbs' Patent Composition for case-hardening. Send for circular. F. W. Tasney, Paterson, N. J.

Davis Key-Seating Machines, kept in stock, by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Extra capacity, hollow-spindle Hand Lathes; correspondence solicited. J. R. Rand, Brattleboro, Vt.

20″, 25″, 28″ B.G. and S. F. upright drills for immediate delivery. Currier & Snyder, Worcester, Mass.

Ice and Refrigerating Machines. 124 built, and all successful. David Boyle, 521 Monroe St., Chicago, Ill.

Drawing Materials, all kinds. Get catalogue. Mention this paper. G. S. Woolman, 116 Fulton st., N. Y.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y

The Improved Tabor Steam Engine Indicator, made and sold by The Ashcroft Mfg. Co., 111 Liberty st., N. Y.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 92 Park row, N. Y.

Curtis Pressure Regulators, Curtis Return Trap, Curtis Damper Regulator. See June 11, p. 12. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

Machinists' supplies, brass goods, m'f'rs' supplies, polishing materials, all kinds wire, metals, etc.; in any quantity. Jordan & Gottfried, 208 Canal st., N. Y.

For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N. Y. Send for des'n.

Patents, American and Foreign, promptly procured and sold on best terms by Jas. H. Lancaster, patent attorney, 187 Broadway, N. Y., and London.

Press for sale. Quick-acting; hole in bed, 8x5; punches to center of 13-inch sheet; 2¼-inch shaft; also four-spindle Drill. B. W. Payne & Sons, Elmira, New York.

New Book on Gears; Tables giving 3,094 diameters, with rules for calculation of movements of shafts, etc.; sent on receipt of P. O. Note; price 50 cts. Address C. B. Long, M. E., Worcester, Mass.

Reed's Engineer's Hand-Book to the Local Board Examinations. Eleventh edition revised and enlarged, with 260 diagrams and 36 large plates. 8vo., cloth, $4.50, post-paid. Catalogue of books free. E. & F. N. Spon, 35 Murray st., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2 post-paid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, the full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York

MANUFACTURES

James Byron will build a brass foundry at Lawrence, Mass.

Reece & Irwin are building a planing mill at Winfield, Kan.

A. C. Green, of Cleveland, Tenn., is to build an electric light plant.

The Defiance (Ohio) Machine Works, destroyed by fire, are being rebuilt.

The Southern Cotton-Seed Oil Company will build a mill at Savannah, Ga.

The Clifton Manufacturing Company will build a large cotton mill at Clifton, S. C.

A Bessemer steel plant is to be built by the Norton Iron Works, of Ashland, Ky.

Considerable extensions are to be made to the water works of Fort Scott, Kan.

The East Hartford (Conn.) Water Company are considering plans for water supply.

The Todd Pulley and Shafting Works, St. Louis, Mo., are building a second foundry.

J. Burner will build a machine shop at Fairmont avenue and Brooks street, Philadelphia.

The Mansfield (Mass.) Water Works Company have petitioned the Legislature for a charter.

The Fairbanks Scale Manufactory, at St. Johnsbury, Vt., will build an addition to their works.

J. F. Everett, of Bennettsville, S. C., is interested in organizing a company to build a cotton factory.

The citizens of Augusta, Kan., are looking for some one to start a machine shop and foundry there.

Charles Hanselt will build a factory, 85x190 feet, on Thirteenth street, near Third avenue, Brooklyn, N. Y.

There is a move in the direction of putting in water works and an electric light plant at Cheboygan, Mich.

The Charleston (S. C.) Gas Company are canvassing the advisability of putting in an electric light plant.

The name of the company which is to erect malleable iron works at Nashville, Tenn., is the Alexander Iron Company.

A four-story brick factory is to be erected by Hertline & Schlatter on the corner of 148th street and Brook avenue, New York.

The Champion Iron Fence Company, Kenton, Ohio, have found themselves obliged to increase their facilities for manufacturing.

According to law, water meters will be required in all places in Milwaukee, Wis., where a considerable quantity of water is used.

The Western Electric Company, Chicago, Ill., will enlarge their facilities for manufacturing by additions to their works, to cost $75,000.

The M. C. Bullock Manufacturing Company, Chicago, Ill., are operating their works double turns, day and night, mainly on mining machinery.

The works of the Lewis Foundry and Machine Company, Pittsburgh, Pa., recently destroyed by fire, will be rebuilt at once. The company employ about 125 men.

The Alabama Rolling Mill Company, Birmingham, Ala., have ordered three Porter-Hamilton engines—300, 460 and 500 horse-power—from William Todd & Co., Youngstown, Ohio.

The Curtis Regulator Company, Boston, Mass., write us that their business in regulators, traps and other specialties is remarkably good. They are selling a good deal on foreign orders.

The Holly Manufacturing Company, Lockport, N. Y., have issued a new illustrated catalogue of fire hydrants. It is complete in description and price-list, and finely illustrated and printed.

F. G. Otto & Sons, manufacturers of surgical instruments at 48 and 50 Sherman avenue, Jersey City, N. J., have commenced the erection of an addition to their works. They will put in a new engine and other machinery.

The Humphreys Manufacturing Company, Mansfield, Ohio, having completed an addition to their foundry, doubling its capacity, enabling them to employ 100 moulders, will at once construct a further addition to their pump works, 60x238 feet.

The Springfield Glue and Emery Wheel Company report business very brisk, being crowded beyond their capacity with a long list of unfilled orders on their hands, notwithstanding the fact that they are employing twice the number of men they were a year ago.

Robert Zell is at the head of an enterprise for the establishment of a steam heating company in Baltimore, Md. It is promised that the work will be far enough advanced by next winter to afford steam heating facilities for manufacturing establishments and dwellings.

The following item has gone the rounds of the technical press: "The Baldwin Locomotive Works, of Philadelphia, expect to turn out 200 locomotives this year, which will exceed their record by about 50." As a matter of fact, there were 550 locomotives built at the Baldwin Works last year.

The *Globe*, of St. Paul, Minn., says the Wisconsin Central Railroad Company have agreed to expend $200,000 in building new railroad shops in that city, and to employ 1,000 men in a year's time. Probably part of the buildings will be freight-houses passenger depot and other needed structures.

The Tanite Company, Stroudsburg, Pa., has issued a new finely-illustrated catalogue of emery grinding machines as made by them. It is a book of 32 large pages, got up in excellent style, and is calculated to impart information to those who are, or ought to be, interested in grinding machinery.

The D. E. Whiton Machine Company, New London, Conn., have a new circular containing illustrations and descriptions of a large variety of chucks manufactured at the works; also of gear-cutting machines and different kinds of centering machines. The catalogue contains complete price-list.

The United States Supply Company, 51 John street, New York, has issued a large illustrated catalogue of mill and factory supplies. They handle supplies for mills, factories, railroads, fire departments, engineers and steam users, including steam pumps, automatic sprinklers and fire-extinguishing appliances.

The Gardner Governor Company, Quincy, Ill., have just received an order for one of the largest governors ever made in this country. It will have a 12″ steam opening, and will weigh 2,100 lbs. It is intended for a 44″x48″ engine now being built by the Iowa Iron Works Company, Dubuque, Iowa, for a Duluth elevator. The Governor Company report trade active, with every prospect for this to be the busiest year in their history.

Referring to question in relation to using natural gas in gas engines, W. J. Ritchey, Pittsburgh, Pa., writes us: "My patents are not for the ignition of natural gas, but for the preparation of it before entering the cylinder or combustion chamber; also for the regulating of it while being used. There are a number of methods of lighting it, but what their success is I cannot say. We have been using natural gas in all our engines for about five months (under my method), reducing the cost from about four dollars a day to thirty cents."

The Pennsylvania Steel Company propose establishing branch works at Tivoli, Md., near Baltimore, which will have double the capacity of their Steelton (Pa.) works. The Maryland location is chosen because of the convenient communication with the existing works, the facilities for procuring the limestone used as a flux, and the facilities it affords for getting rid of the waste product, as well as for getting coal and coke by boat, and importing ores from African, Cuban, Spanish and other Mediterranean ports. The company has purchased 1,000 acres of land, and will at once proceed to erect works. A very large number of men will be employed.

The Stiles & Parker Press Company, of Middletown, Conn., have bought a number of lots in New York city, near the new and handsome Mott Haven Depot, now nearly completed, at 138th street and Railroad avenue. They will at once proceed to erect extensive works, and expect to occupy the new premises about October or November next. The new works will have side-track connection with three railroads—the New York Central, New Haven and Harlem—and are only ten minutes' distant by frequent trains from the Grand Central Depot at 42d street. They are also only a short distance from the present terminus of the Third Avenue Elevated Railroad, and have advantageous canal communication in the rear.

A new enterprise is soon to be located in Oakland, Maine, known as the Dustin & Hubbard Manufacturing Company. The authorized capital stock is $100,000, and $75,000 has already been subscribed. The establishment to be built, is an iron and wood-working manufactory, where engines, lathes, planes, upright drills, shapers, milling machines, etc., are to be made. The new company have bought $20,000 worth of real estate adjoining Hubbard, Bragg & Co.'s establishment, and are now putting up a large one-story building, where is to be their iron-working factory. The Dustin Manufacturing Company have been located at Dexter for many years. The new concern at Oakland now have $18,000 worth of orders ahead, and will probably not get to running until September 1st.—*The Commercial Bulletin.*

Machinists' Supplies and Iron.

NEW YORK, June 2, 1887.

Trade prospects have undergone no change during the past week. But increased railroad earnings and good crop prospects inspire confidence in the future.

Iron—There is slight improvement in the demand for American pig, but it is not of sufficient magnitude to affect prices materially. It is noticeable, however, that there is no pressure to sell. Standard brands are held firm. We quote for standard brands No. 1 X Foundry, $20.50 to $21.50; No. 2 X, $19.50 to $20; Grey Forge, $18 to $18.50.

Scotch Pig—There are some indications that prices of Scotch brands may rule a trifle lower, though this may be prevented by smaller importations; there appears to be a tendency in that direction. We quote: Coltness, $22 to $22.50; Gartsherrie, $21.50 to $22; Summerlee, $21.50 to $22; Eglinton, $20.50 to $21; Dalmellington, $20.50 to $21.

Antimony—Hallett's, 7.75c.; Cookson's, 9c.

Copper—There have been but few sales, and prices are nominal, at 10c. for Lake; other brands, 9c. to 9¼c.

Lead—Prices are held fairly firm, at 4.65c. to 4.70c.; several sales of car loads have been made at the first-named price.

Spelter—Refined, 5¾c. to 6c.

Tin—Prices have been quite irregular, in sympathy with the London market. Jobbing lots of Banca have sold at 23½c.; Straits and Malacca, 23.20c.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate, 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—A few good competent machinists to set up work in shop. Apply to 115 Liberty st., N. Y.

Wanted—Situation by mech. draftsman; vicinity New York preferred. Address K., AM. MACHINIST.

A man with theoret. and practical experience wishes situation as designer or foreman of drawing room. Address M. E., AM. MACHINIST.

Wanted—To make arrangement with a good house to sell a line of steam goods; have had 14 years' experience on the road; good references. Address J. F. M., care AM. MACHINIST.

Wanted—A mechanical designer and draftsman in heavy saw mill machinery. Apply, giving references and wages wanted, to The Wm. Hamilton Mfg. Co., Peterborough, Ontario, Canada.

Wanted—Competent draftsman, experienced on general machine shop, blast furnace and rolling mill work; give references and state salary expected. Address Machine Shop, care AM. MACH.

Wanted—At the Pittsburgh Locomotive Works, Pittsburgh, Pa., foreman patternmaker; must thoroughly understand locomotive work. Address D. A. Wightman, supt., stating age, experience and wages expected.

Foreman wanted who has had some experience in watch factory or similar machinery; must understand managing men and work to the best advantage. Address Moseley & Co., Elgin, Ill., giving reference, experience, age and wages.

Machine shop foreman wanted in Northwestern Pennsylvania; one familiar with stationary engine, saw mill and general jobbing work; must be a live man, and acquainted with modern methods of doing work. Address Jones, AM. MACHINIST.

Wanted—For foreman of light hardware manufactory employing about 20 hands, a young man of good executive ability and experience in tool making; a permanent position with a rapidly-growing concern. Address Moore & Barnes Mfg. Co., Syracuse, N. Y.

Wanted—Situation by a young engineer, A. M. I. C. E., well up in fast steam yacht and launch building, torpedo boat, yacht and launch machinery, drawing office and shops; long experience at a first-class firm in Great Britain. Address A. M. I. C. E., American Exchange, 449 Strand, W. London, England.

Wanted—By August 1st a superintendent of the machine shop department of a new factory for the production of certain specialties in iron and brass; must be a first-class toolmaker and experienced in management of men; write full particulars, age, experience, general qualifications, wages expected and references. Address A. B. C., AM. MACHINIST.

✢ MISCELLANEOUS WANTS. ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Crescent Boiler Tube Expander; second to none, price in reach of all. Crescent Mfg. Co., Cleveland, O.

The Crescent Link Belt Coupling; something new; sample free. Crescent Mfg. Co., Cleveland, O.

Light mach'y of all kinds built at short notice Edmund Mills, 8 Dey st., Jersey City Heights, N. J.

Stationary and boat engines, boilers; best made cheapest price. Washburn Engine Co., Medina, O.

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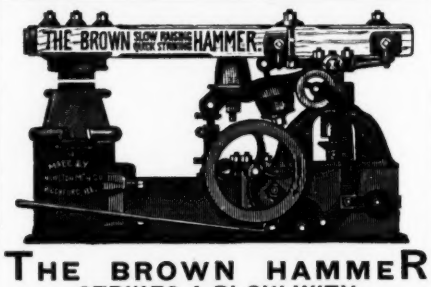

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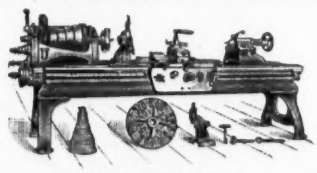

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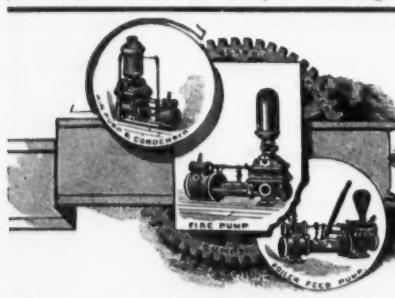

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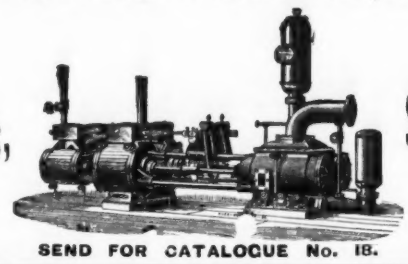

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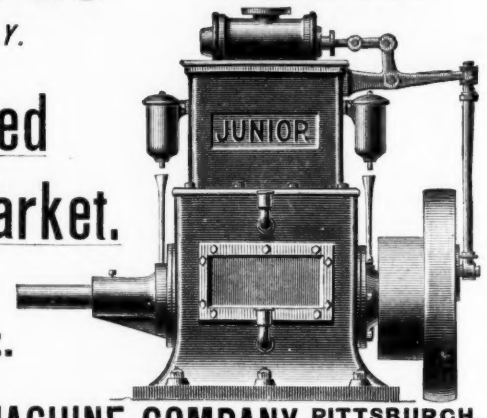

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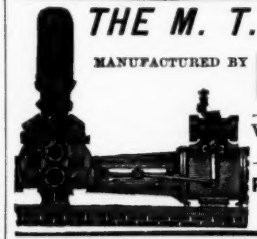

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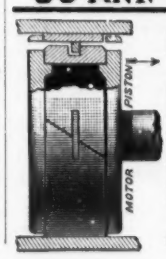

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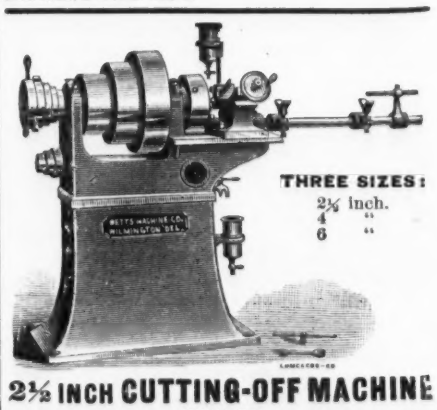

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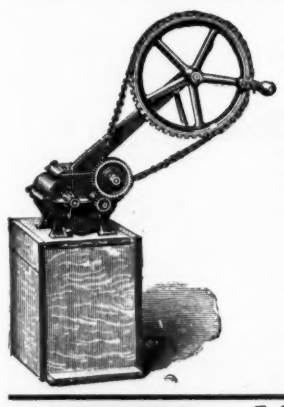

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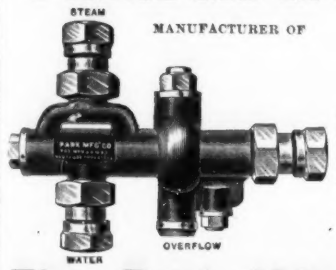

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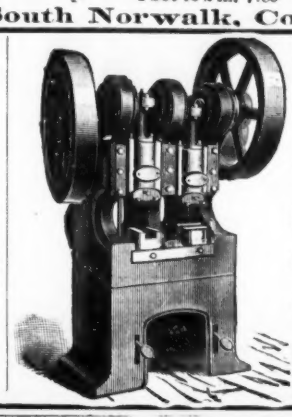

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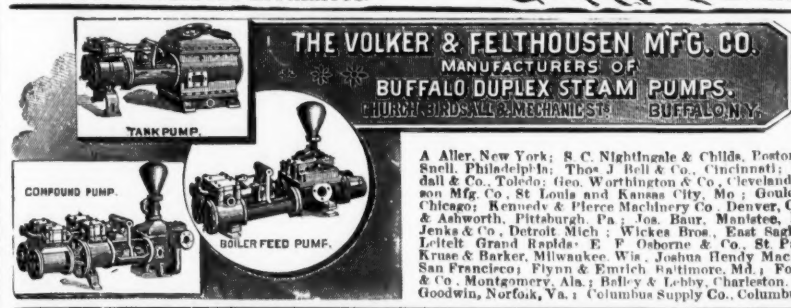

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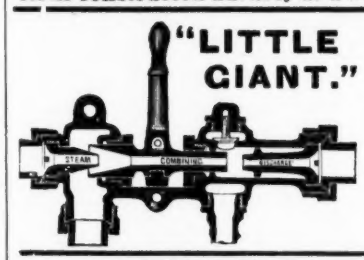

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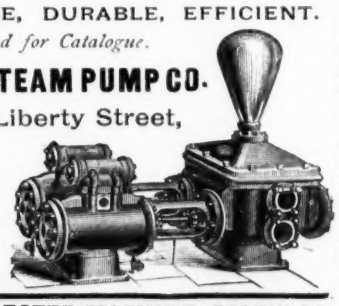

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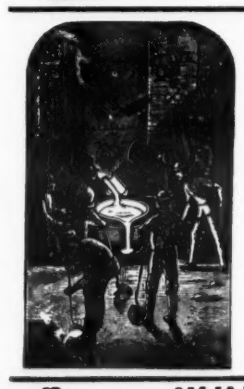

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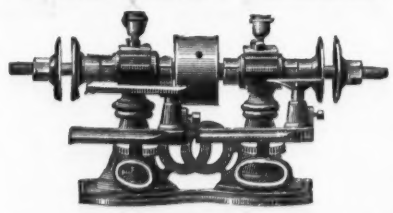

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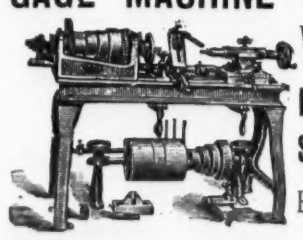

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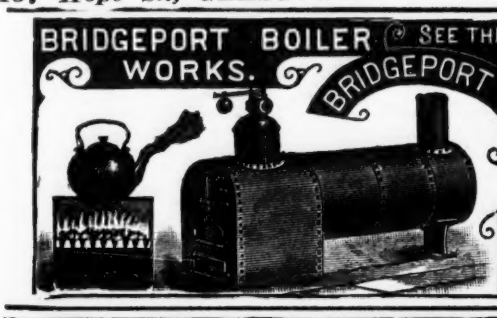

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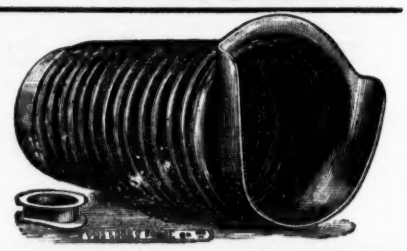
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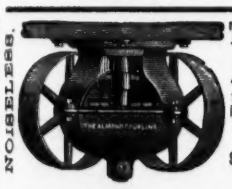
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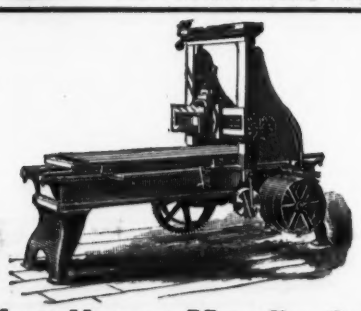
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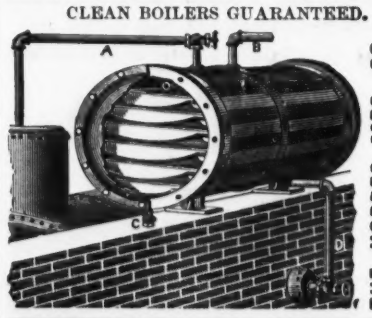

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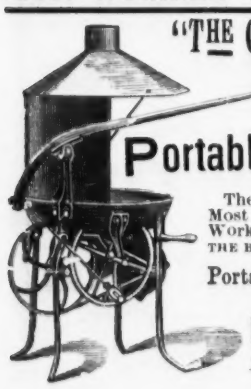
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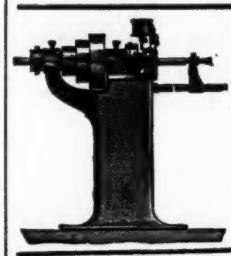
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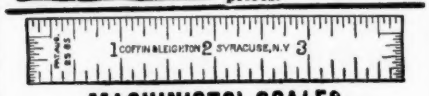

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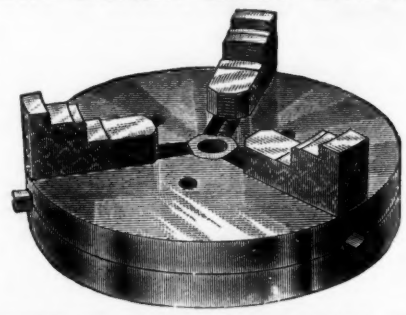
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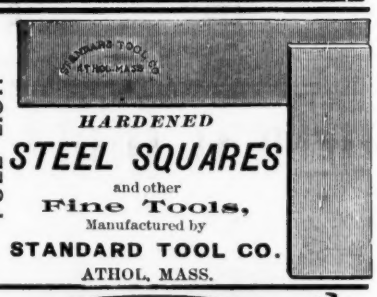

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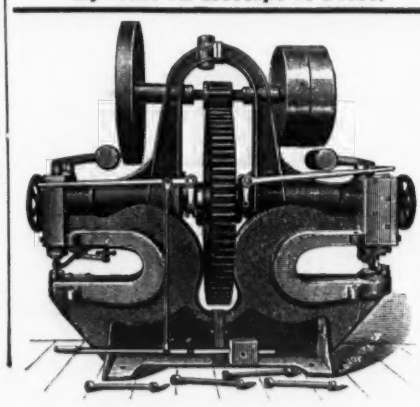
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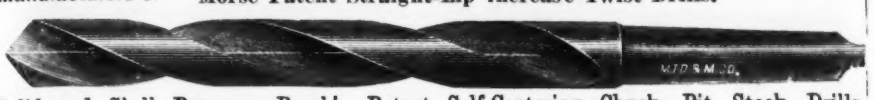

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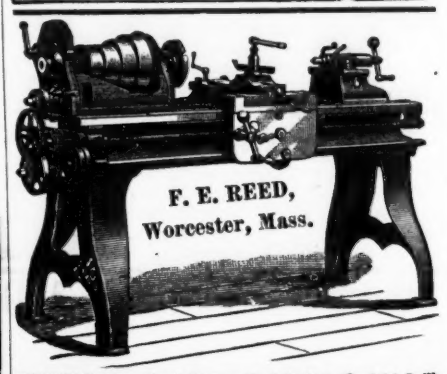

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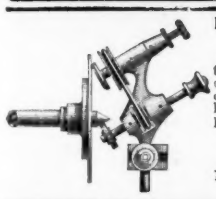

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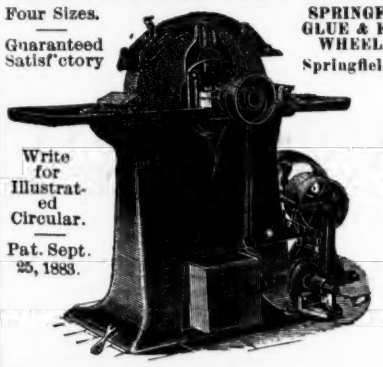

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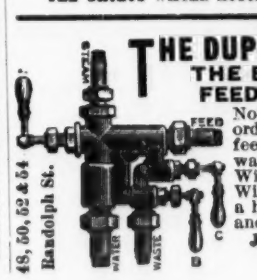

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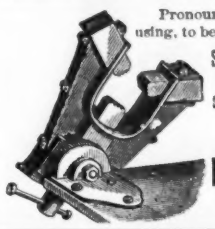

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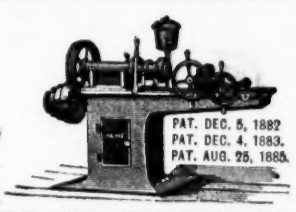

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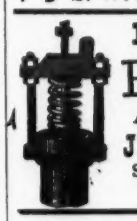

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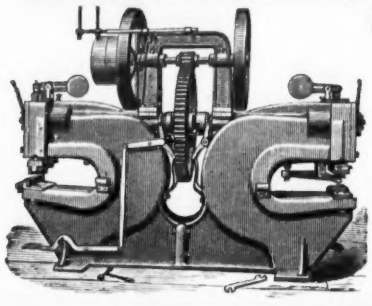

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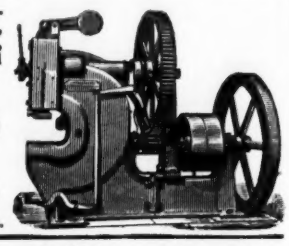

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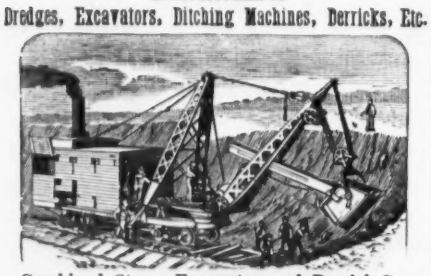

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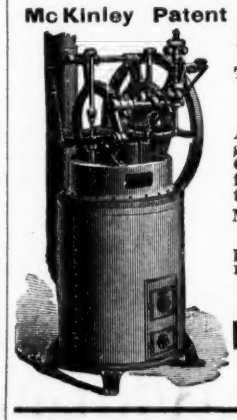

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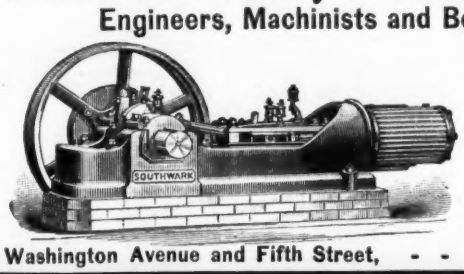

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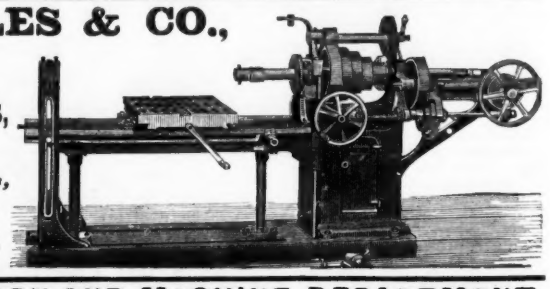

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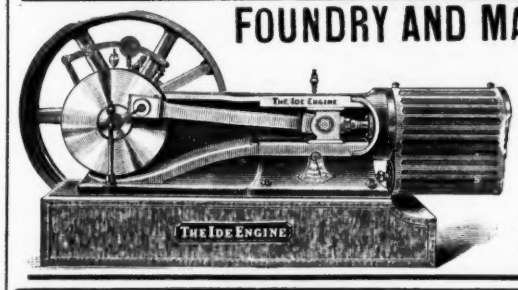

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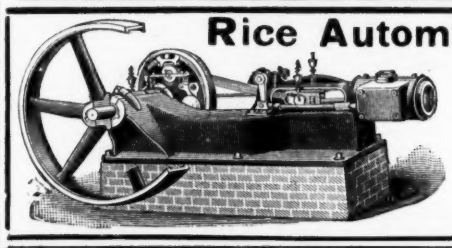

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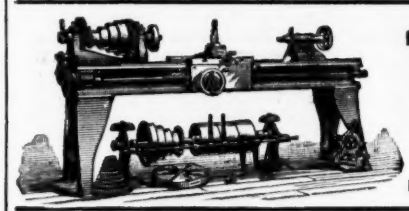

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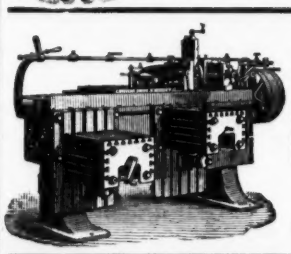

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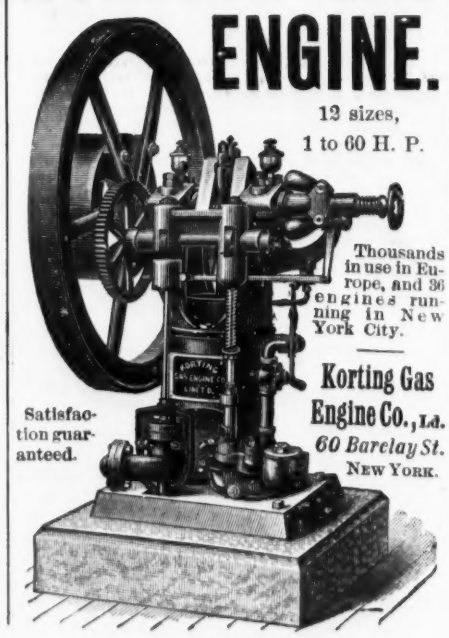

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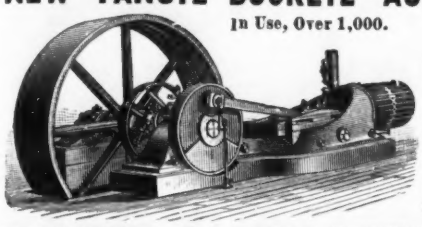

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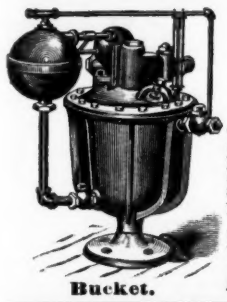

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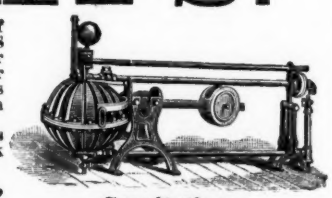

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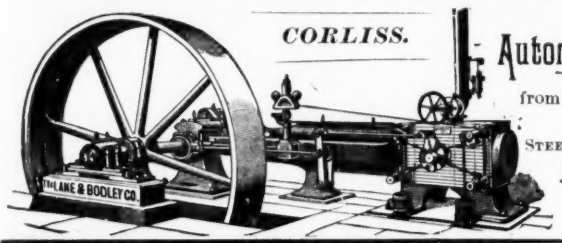

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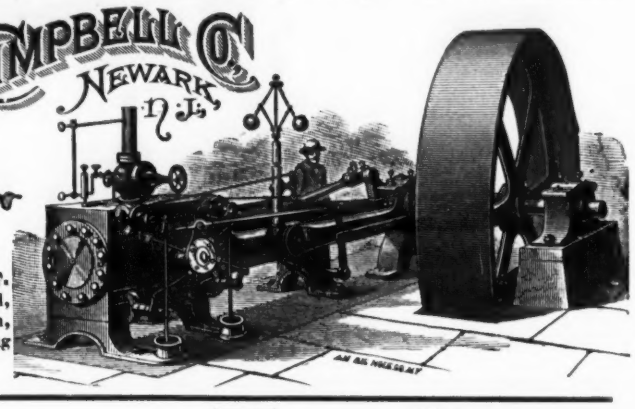

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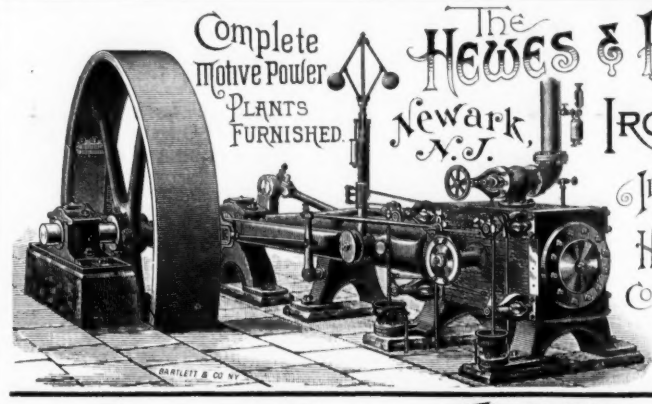

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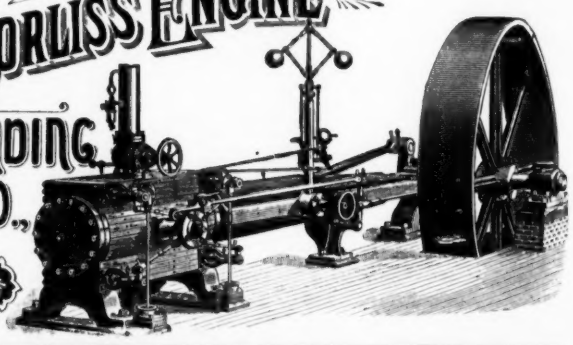

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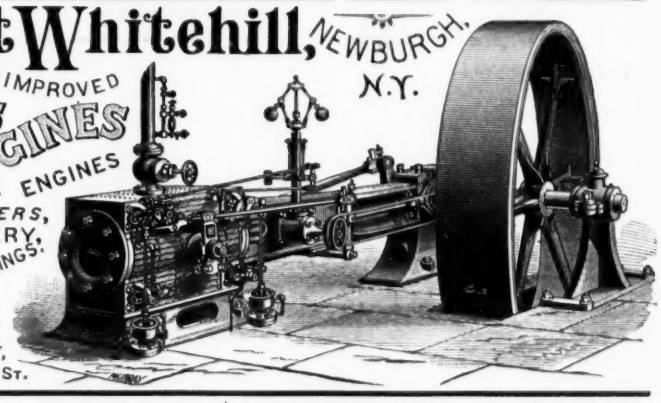

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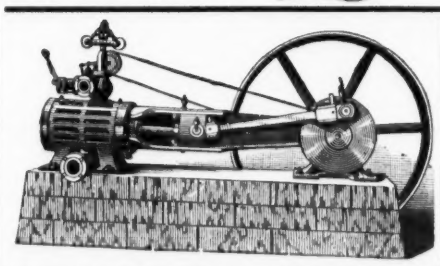

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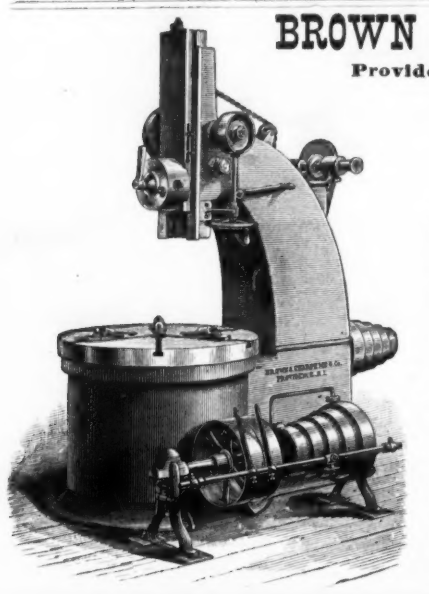

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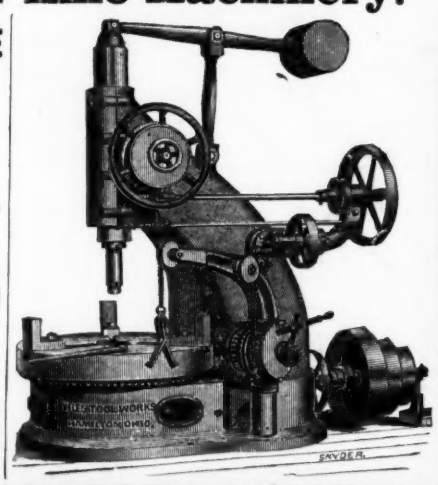

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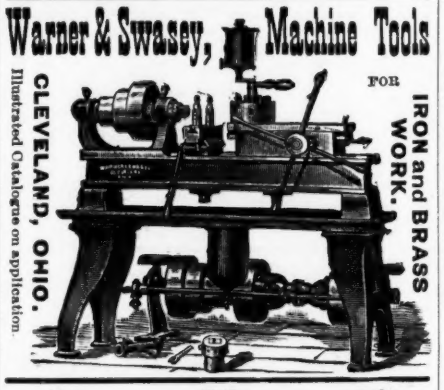

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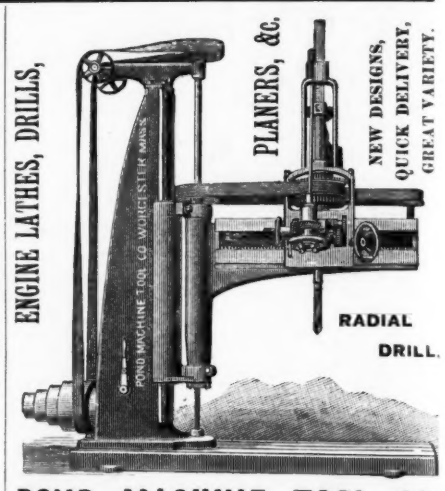

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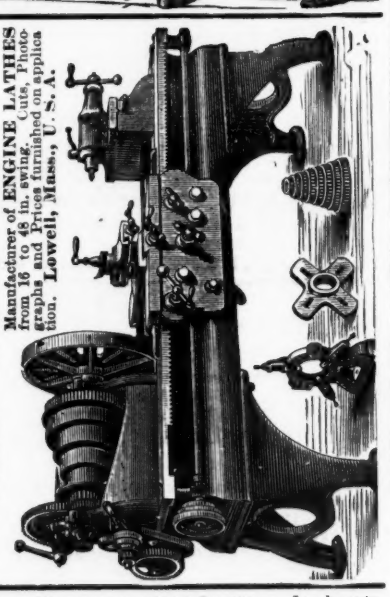

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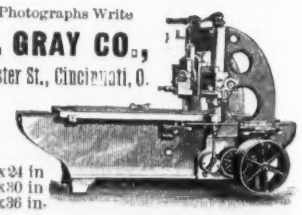

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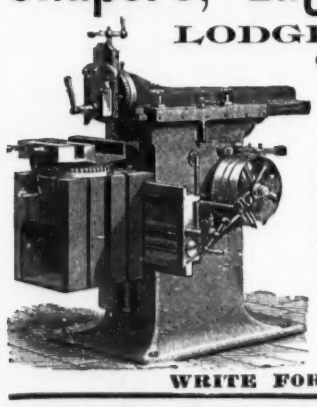

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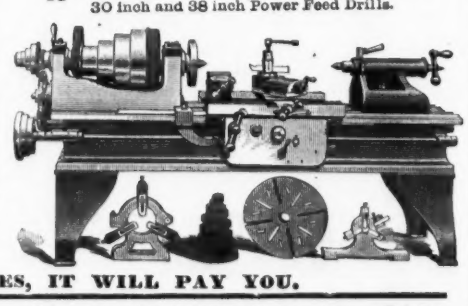

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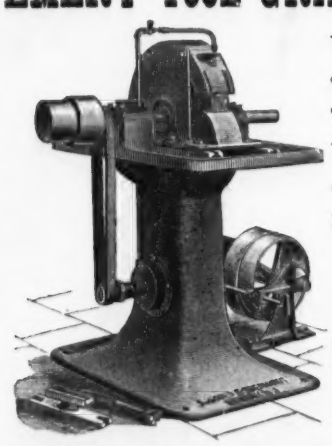

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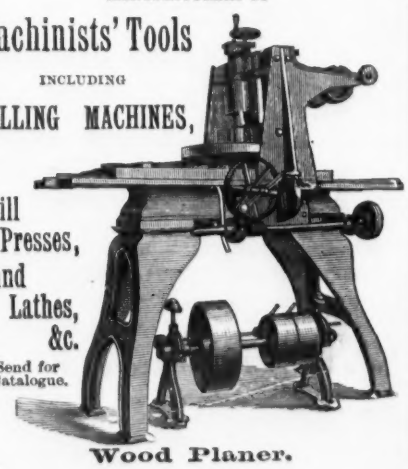

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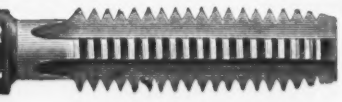

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